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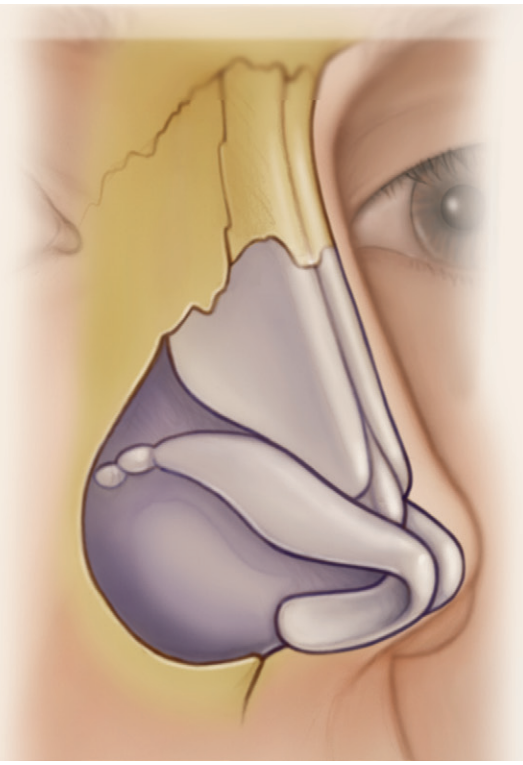

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Chapter 4: Basic Rhinoplasty

4.1 The nose hair is clipped and the hair particles are removed using adhesive tape.

4.2a If a turbinectomy is indicated, the turbinates are injected bilaterally with xylocaine containing 1:200 000 epinephrine using a 25-gauge spinal needle.

4.2b The nose is packed with gauze saturated in Afrin™ or Neo-Synephrine™ solution. This is placed as far cephalically and posteriorly as possible to cause vasoconstriction in the areas that are hard to reach through injection.

4.2c The external nose is injected copiously with xylocaine containing 1:200 000 epinephrine with a 27-gauge needle. This injection is started at the radix and, while the left index finger protects the orbital area, the lateral portion of the nose is injected both medial and lateral to the nasal bone on either side. Additionally, the columella, as well as the roof of the nose on either side, is injected to achieve vasoconstriction in the anterior vessels.

4.3 After waiting a few minutes for vasoconstriction to occur, the injection is repeated, this time using 0.5% ropivacaine containing 1:100 000 epinephrine and 150 units/ml hyaluronidase. This injection is started at the radix again and, while the index finger protects the orbital area, the lateral portion of the nose is injected both medial and lateral to the nasal bones on each side. Additionally, the columella and the roof of the nose on either side is injected to achieve more vasoconstriction in the anterior vessels.

4.4 The step incision is marked in the narrowest portion of the columella while the nostrils are retracted anteriorly. Prior to the incision, the tip is allowed to retract to ensure that the incision is not too close to the anterior border of the nostrils. The skin incision is then started with a no. 15 blade.

4.5 A small double skin hook is placed in the step incision while a single hook retracts the nostril. The marginal incision is made in the columella and extended into the right nostril while the nondominant middle finger everts the vestibular lining.

4.6 The skin hooks are placed in position and a pair of baby Metzenbaum scissors is used to carefully separate the soft tissues of the columella from the underlying medial crura with a gentle spread and cut technique.

4.7 The soft tissues are separated from the underlying lateral crura of the lower lateral cartilages, staying as close to the cartilages as possible. This is continued until the anterocaudal septal angle is adequately exposed.

4.8 An Obwegeser periosteal elevator is used to elevate the periosteum, taking care to maintain the periosteum attached to the overlying soft tissues.

4.9 A guarded burr is then use to deepen the radix using a side-to-side motion.

4.10a The dorsal hump is removed with a pull-and-push motion using a carbide rasp. The rasping course is oblique and the nasal bones are protected by the fingers to minimize the chance of inadvertent fracture of the nasal bones and septum.

4.10b The goal is to create a step between the optimally contoured nasal bones and the remaining cartilaginous hump to be removed later on the basis of the preoperative assessment.

4.11 The lateral crus stabilizer is then used to harness the lower lateral cartilage. Maintaining a width of about 4–5 mm anteriorly and 6 mm posteriorly, the excess portion of the cartilage is removed.

4.12a The soft tissue overlying the anterocaudal septum is then removed to expose the anterocaudal septum.

4.12b Using the sharp end of the septal elevator, the mucoperichondrium is separated from the anterocaudal septal cartilage. Sometimes it is necessary to score the mucoperichondrium with a no. 15 blade to initiate the dissection in the proper plane. Exposure of the gray, shiny cartilage is an indication that the right dissection plane has been entered. At this point, using the roll of the septal elevator, the mucoperiochondrium is separated from the overlying lower lateral cartilages and the roof of the nose.

4.13ai The upper lateral cartilages are separated from the septum using a pair of Joseph scissors.

4.13aii The cartilaginous dorsal hump is now removed using a no. 15 blade.

4.13bi The mucoperichondrium is dissected along the caudal border of the septum on both sides.

4.13bii The dissection is continued along the left side of the septum in the submucoperichondrial plane as far posteriorly and caudally as possible.

4.13biii The mucoperichondrium attached to the caudal septum is carefully separated and the dissection is continued until the vomer bone is exposed. It is often easier to start the dissection posteriorly and continue it anteriorly.

4.13biv The sharp end of the septal elevator is used to incise the septal cartilage leaving at least 1.5 cm anteriorly and caudally to maintain the dorsal support. Next, the mucoperichondrium is elevated on the right side of the septum as far posteriorly and caudally as possible.

4.13bv The septal elevator is then used to separate the caudal septum from the vomer bone caudally with a great deal of patience and care to avoid perforation of the mucoperichondrium. The dissection is advanced posteriorly until the entire quadrangular cartilage is separated from the maxillary crest of the vomer bone. The cartilage is also separated from the perpendicular plate of the ethmoid bone with the sharp end of the elevator. The completely mobilized cartilaginous septum posterior and caudal to the L strut is then removed.

4.13bvi The mobilized portion of the quadrangle cartilage and the residual portion of the deviated cartilage, which is often dislodged to one side of the septum, are removed.

4.13bvii The crest of the vomer bone is also removed, if deviated. Often, this part of the septum protrudes to one side as a spur. The resection is continued until all the irregularities are eliminated. Sometimes it is necessary to cauterize the vessels along the base of the vomer bone to minimize the potential for postoperative bleeding.

4.13c One of the critical aspects of septoplasty is removing the overlapping portion of the caudal septum, which is often dislodged to one side of the septum. This will allow for a swinging-door-type movement of the septum.

4.13d The mobilized caudal septum is then repositioned over the anterior nasal spine and fixed into position using 5-0 PDS suture. However, it is crucial to make sure that the nasal spine is in the correct position prior to fixing the septal cartilage to it.

4.14a The turbinates are then conservatively trimmed using a pair of turbinate scissors, removing only the redundant portion and leaving normal-sized turbinates behind.

4.14b The suction cautery is then used to gently cauterize the raw surface of the turbinates to minimize postoperative bleeding.

4.15 Doyle stents covered with bacitracin ointment are then introduced into each side of the nasal cavity and fixed into position using a 4-0 polypropylene suture passed through the membranous septum. The ends of the suture are left long so they can be easily identified and are placed inside a tube in order to avoid irritation of the nasal lining.

4.16 The medial osteotomy is initiated with a 4 mm osteotome placed medial to the nasal bone and the osteotomy is completed with gentle tapping on the osteotome.

4.17 The lateral anteroposterior percutaneous osteotomy is accomplished using a 2 mm carbide osteotome. It begins anteriorly and is extended posteriorly in the subperiosteal plane.

4.18ai The lateral osteotomy begins with a stab wound incision in the vestibular lining close to the pyriform aperture. A Joseph's elevator is then used to create a tunnel in the subperiosteal plane over the nasal bones.

4.18aii The lateral osteotomy is then started using a guarded osteotome, which is gently advanced in the subperiosteal plane while its position is monitored with the index finger of the nondominant hand. Upon completion of the osteotomy, the nasal bone can be moved medially with gentle pressure.

4.18b The upper lateral cartilages are trimmed after completion of the osteotomy.

4.19a Spreader grafts are prepared using a piece of straight septal cartilage and the ends are beveled to minimize visibility.

4.19b The spreader grafts are then placed into position, extending from underneath the nasal bones to the caudal end of the upper lateral cartilages, and are fixed in position using a double armed 5-0 polyglactin suture. After one needle is passed, the position of the spreader grafts is adjusted and then the second needle is passed and the suture is tied to align the cartilages with the dorsum. At least two sutures are utilized to avoid rotation of the graft. Again, the position of the grafts is monitored throughout this process to insure proper alignment and symmetry.

4.20a The upper lateral cartilages are then approximated to the septum using 5-0 PDS. Since the intention is to rotate the anterior septum to the left side, the stitch is placed more cephalad on the left side and more caudally on the right side. In this way, using the left upper lateral cartilage as an anchor, the septum can be rotated to that side. As the suture is tightened, the septum rotates to the patient's left to be aligned with the rest of the facial structures. A second suture is often necessary to avoid bulging of the upper lateral cartilages. These stitches should be placed as anteriorly as possible to avoid constriction of the internal valves.

4.20bi The columella strut is prepared using the longest and straightest portion of cartilage available. In fact, this is the first piece that is harvested. The length of the graft is, to a great deal, dependent on its purpose.

4.20bii The soft tissue between the middle crura is excised using the coagulation power of the cautery.

4.20biii The columella strut is placed in position while the domes are aligned and retracted with a double skin hook. Using methylene blue and brilliant green, the columella is tattooed with a 25-gauge needle.

4.20biv Guided by the tattoo marks and using 5-0 PDS, two stitches are placed through the medial crus on one side, passed through the columella strut and the opposite medial crus, and tied in position to insure proper alignment of the cartilages. The second stitch is placed in a similar fashion, aligning the medial crura and the columella strut. Prior tattooing of the medial crura and the columella strut avoids unnecessary repeated replacement of the sutures. The excess portion of the columella strut is then trimmed if necessary.

4.21a A transfixion incision is made along the cephalic border of the medial crura and the redundant portion of the membraneous septum is excised to facilitate cephalic rotation of the tip.

4.21b The caudal septum is then excised in a triangular shape based anteriorly to facilitate cephalic rotation of the tip.

4.21c A tip rotation suture is placed using 5-0 nylon. The suture is passed through the medial crura and tied, and the needle is then passed in between the medial crus on one side and the columella strut. A bite is taken of the anterocaudal septum including a minimal amount of soft tissue and the suture is then passed between the opposite medial crus and the columella strut and tied incrementally to oppose the cephalic border of the medial crura to the caudal border of the septum. The tip position should be carefully monitored throughout this process.

4.22a The footplates are exposed through the transfixion incision and the redundant portion is excised if necessary.

4.22b If the footplates are displaced laterally, a 5-0 PDS suture is passed through the footplate on one side and then passed to the opposite side cephalad to the footplates. The suture is then passed through the opposite footplate and tied incrementally.

4.23 A subdomal graft is being placed by creation of a pocket under each dome first. A piece of cartilage graft usually measuring about 10 mm long, 1.5 mm thick, and 1.5 mm wide is passed under the dome on one side and then passed under the opposite dome and fixed in position using 6-0

polyglactin sutures. At least two and often three sutures are needed to avoid dislodgment of the graft.

4.24a Next, a supratip suture is placed if needed. To do so, a temporary columella suture is placed and the supratip breakpoint is identified and tattooed using a 25-gauge needle and methylene blue. The supratip skin is approximated to the underlying anterior septal angle guided by the tattoo marks.

4.24b The columella incision is then repaired using 6-0 fast-absorbable catgut sutures. The angles of the step incision aid the precise placement of the sutures.

4.25a A graft 10–12 mm long and 2–3 mm wide is crafted from the thinnest portion of the septum or the removed cephalic margin of the lower lateral cartilage. The anterior end of the cartilage graft is beveled to avoid visibility. A pair of iris scissors is used to create a pocket within the thickness of the alar rim as close to the rim as possible. The graft is inserted and fixed in position using a 6-0 fast-absorbable catgut suture.

4.25b The alar base incision is designed by removing most of the tissue from the nostril sill, leaving enough laterally to facilitate a graceful transition from the alar rim. The incision is made using a no. 15 blade while the soft tissues are retracted. The alar base is excised using a combination of knife and electrocautery needle and the muscles at the base of the excised area are released and cauterized gently. The incision is then repaired using 6-0 fast-absorbable catgut and the lateral flap is approximated to the medial flap in a very precise fashion using multiple stitches.

4.26a The nose dressing is a very important part of the rhinoplasty in order to approximate the freed soft tissues to the underlying frame. Mastisol® is used on the nose skin to help the adhesion of the Steri-Strips™, which are then applied precisely.

4.26b Routinely, a combination of a metal splint and Aquaplast™ is used over the Steri-Strips™.

4.26c The Aquaplast™ portion of the splint provides stability while the metal portion of the splint aids precise molding of the Aquaplast™.

Chapter 6: Tip Sutures

6.1 The interdomal suture can be placed as a simple stitch or in a figure-of-eight fashion. A simple stitch may overlap the domal cartilages, while the figure-of-eight suture will not only avoid this but, if the domes are overlapping or are misaligned cephalically, will align them.

6.2 When a transdomal suture is utilized, it is preferable to place an independent transdomal suture across each dome to avoid asymmetry. The suture is started from the medial aspect of one dome, passed across the dome laterally without violating the lining, passed lateral to medial, and then brought back across the dome and tied in the medial side of the dome.

6.3 To place a medial crura suture, a 5-0 PDS stitch is passed through the medial crus on one side, passed through the opposite side, and tied incrementally while watching the domes to ensure that they are not approximated too much.

6.4 To place the Tebbetts lateral crura spanning suture, this horizontal mattress suture is started from the medial portion of one lateral crus, passing the suture medial to lateral on one side, passed cephalically lateral to medial, crossed over the dorsum. It is then passed through the opposite lower lateral cartilage and brought back. The suture is then tied incrementally while the assistant holds the knot with a pair of smooth forceps to avoid overtightening.

Chapter 7: Achieving Optimal Tip Projection

7.1 Use of a tip punch to harvest a tip graft.

7.2 The graft is removed from the punch.

7.3 The tip graft is fixed in position using 6-0 polyglactin sutures. Its position is monitored three-dimensionally to ensure that it is placed symmetrically.

Chapter 9: Correction of the Overprojected nose

9.1 The domes are separated from the underlying lining using a pair of iris scissors. The extent of the lining will depend on the amount of cartilage that needs to be removed.

9.2 The domes are lowered beyond what is optimal for the patient considering the thickness of the cartilage that will be applied over the existing medial and lateral crura.

9.3 The columella strut is placed in position and trimmed.

9.4 A tip graft is harvested using the tip punch. The graft is placed in position and fixed using 6-0 polyglactin. The first suture will fix the graft to the underlying medial crus. Next, the graft is sutured to the lateral crus on the same side. As the suture is being tied, the position of the graft is monitored three-dimensionally. The graft is then sutured to the opposite side.

9.5 The redundant portion of the lining under the newly constructed dome is excised in a triangular shape. The resulting defect is then repaired using 5-0 chromic interrupted sutures.

Chapter 13: Controlling the Nostril Size

13.1 A crescent piece of the redundant soft triangle lining is excised to elongate the nostril.

Preface

There is no procedure in the plastic surgery field that demands as much finesse, and as many years of practice to master as rhinoplasty does. In fact, a rhinoplasty technique that provides consistent, flawless outcomes has been elusive to the majority of us. This challenging operation commands keen scrutiny of every result and appreciation of the maneuvers that succeed in order to experience steady progress. Over the years, we have been able to reduce some of the ambiguities involving this surgery, discovered most of the reasons for its failures, and have developed safeguards to lead to more pleasing and natural outcomes and fewer revisions. In this field, patience is a virtue since many of the results cannot be fully assessed until at least one year from the surgery. This, naturally, flattens the learning curve and it is often compounded by the fact that during the early years of practice following completion of plastic surgery training, the rhinoplasty cases are rare and most patients choose the more experienced surgeons for their rhinoplasty. As it will be demonstrated in this book, most of the passage of time related changes in the nose are directly linked to the thickness of the skin. As the skin becomes thinner, the flaws that were not initially so discernible may become evident. Sometimes this takes years. It is, therefore, paramount to create a nose frame that would provide the most satisfying outcome no matter how thin the skin gets with time. Indeed, with experience, there comes a point in practice when one can create the type of frame that would provide this objective. One of my hopes from sharing this information with our colleagues is to help them to reach that point sooner and alter the learning curve auspiciously.

Another powerful factor that makes this operation exceedingly taxing is the interplay that occurs with each maneuver. As one completes each rhinoplasty step, it not only achieves the intended goals, there are multiple unintended changes that take place which may have synergestic, antagonistic or independent consequences. These have been elaborately discussed in Chapter 3 since complete understanding of rhinoplasty dynamics is one of the cardinal essentials for a successful rhinoplasty.

This book is a product of 31 years of experience, perpetual learning and transition from the results that began with many suboptimal and rare pleasing outcomes, common features of the rhinoplasty results in early 1980's for most

surgeons, and has culminated into logical steps with reproducible results and fewer revisions. When you review the patient examples in the chapters, you may conclude that while the noses may share some common characteristics, they are not exactly alike and I have tried to avoid prototype noses. I owe this progress to my craniofacial training which led me to design a cephalometric principled planning of the rhinoplasty that takes the entire face into consideration and creates congruity between the nose and the rest of the face. However, my quest for consistent perfect rhinoplasty outcomes has continued and there is rare day that I am in the operating room and fail to learn something new that improves my results.

To date, 54 articles have been published based on studies that have been conducted by our team to lend as much scientific support to the opinions expressed in this book as possible. Additionally, I have tested all of the sensible techniques that have been introduced by our colleagues and if reproducible with achievement of the claimed positive outcomes, they were incorporated in my practice and are discussed in this book. I extend my deepest gratitude to our colleagues for sharing their knowledge with all of us and helping us to advance the rhinoplasty field. Because of their efforts, the rhinoplasty results that we produce today are enormously superior to what we used to achieve 3 decades ago. We owe this progress to Jack Sheen, Jack Gunter and other rhinoplasty educators who unselfishly shared their rhinoplasty knowledge with us.

In this composite publication, we have incorporated a text with 3D animated and illustrations, and videos. Although the videos have been segmented for the ease of reference, when chained together, they will demonstrate the entire surgery from the beginning to the end. Essentially every patient photograph utilized in this book includes all four standard views of the patient in the same or subsequent chapters for the sake of completeness. The patients examples included here have a minimum of 1 year, and commonly, a longer follow-up.

It is my earnest hope that this complete package of information will provide the readers with all the tools they need to improve their results and achieve more consistent, gratifying, and natural outcomes.

Bahman Guyuron, MD

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Dedication

This book is dedicated to Lora, Glen, Greg, Grant, Sarah, and Shawn for understanding my passion for teaching and the compromises that they made in sharing my time with my colleagues, students, residents, and fellows.

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CHAPTER 1

Surgical Anatomy and Physiology of the Nose

Chapter Contents

Rhinoplasty Terminology 3
Soft Tissues of the Nose 7
Skin 7
Soft Tissue Layers Beneath the Skin 8
Nasal Muscles 8
Blood Supply 10
Sensory Nerve Supply 12
External Nasal Frame 12

Pearls

- Soft tissues of the nose are thick cephalically and caudally and become thinner in the center. It is for this reason that the nose frame that is totally straight on the profile will most likely not induce an optimal dorsal outline.
- There are 4 distinct layers that occupy the area between the skin and underlying osteocartilaginous frame, including the superficial musculoaponeurotic system (SMAS), fibromuscular layer, deep fatty layer, and periosteum/perichondrium.
- Damage to the pars alaris muscle may result in collapse of the external nasal valve.
- Release of the depressor septi nasi muscle not only eliminates the depressor effect on the nasal tip, it may also cause a slight ptosis of the

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upper lip which may or may not be beneficial to the patient depending on the amount of incisor show.

- African-American noses often have short nasal bones. This becomes significant in maintaining the width of the nose after nasal bone osteotomy.
- Osteotomy and medial repositioning of the long nasal bones will have a deleterious effect on the airway since it will transpose the upper lateral cartilage medially as well.
- The confluence of cartilaginous nasal septum, ethmoid bone, and nasal bone is called the keystone area.
- Overall, the two paired middle and medial crura structures constitute the caudal leg of the basal nose tripod, the other two legs of which comprise the lateral crura. Understanding the tripod mechanism in reduction of tip projection and its rotation is absolutely crucial to the delivery of tip projection objectives.
- The lower lateral cartilage is commonly short and weak in non-Caucasian noses.
- The angle between the caudal border of the upper lateral cartilage and the septum, usually 10–15°, composes the internal valve along with the border of the inferior turbinate.
- Continuous interweaving of the perichondrium and the periosteum at the junction of the vomer bone and the cartilaginous septum anteriorly makes dissection in this part very difficult. It is easier to dissect the mucoperiosteum and mucoperiostium posteriorly and extend it anteriorly during the septoplasty.
- The highly vascular area that receives arterial circulation from the superficial terminal branches of the anterior ethmoid, the sphenopalatine, and the superior labial arteries is called Kesselbach's plexus, which is a common source of anterior nasal bleed because of the robust blood flow.
- The optimal turbulence of the nose will occur with a nasolabial angle of 90–115°.

An essential initial step in the arduous ascending pathway to the successful rhinoplasty is a clear understanding of the nasal anatomy and its function. It has been repeatedly stated that form and function are inalienable components of most facial structures and the nose is no exception. It is of cardinal importance to recognize that the nose has several important functions and maintaining sound structural support during the rhinoplasty is crucial to its shape and physiology. This is where the understanding of the nasal anatomy becomes an irreplaceable component of a positive rhinoplasty outcome. In this chapter, we will first discuss the anatomy of the nose, followed by its function as it relates to the rhinoplasty. We will begin with the surface of the nose and extend the discussion to the deeper structures.

Rhinoplasty Terminology

Even though the nose occupies only a small area of the face, the terminology used to define the different parts of the nose is vast and confusing. In order to improve understanding of this terminology, we will try to list and explain these terms, as described in different textbooks,[1,2,26] including all variations that have been used to describe a specific site (Figures 1.1–1.4).

- *Accessory cartilages* – small cartilages located between the lateral ends of the lateral crura and the pyriform aperture
- *Ala* – the lateral nostril wall extending from the tip to the upper lip and cheek
- *Alar groove* – the oblique skin depression between the tip and the ala
- *Anatomic dome* – the most anterior projected portion of the lower lateral cartilages between the medial and lateral crus
- *Anterior septal angle* – the junction of the anterior and caudal cartilaginous septum

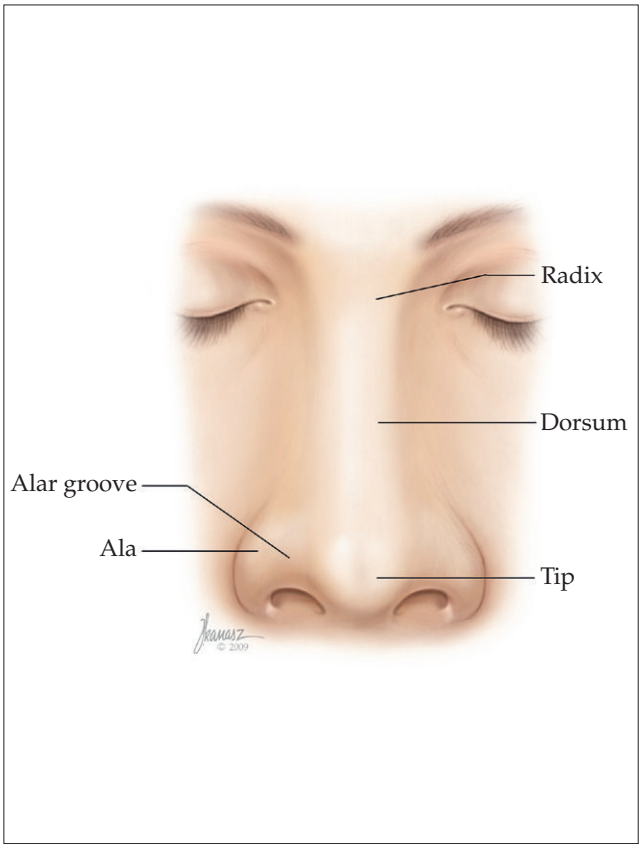

Figure 1.1 Front view of the different anatomical components of the nose.

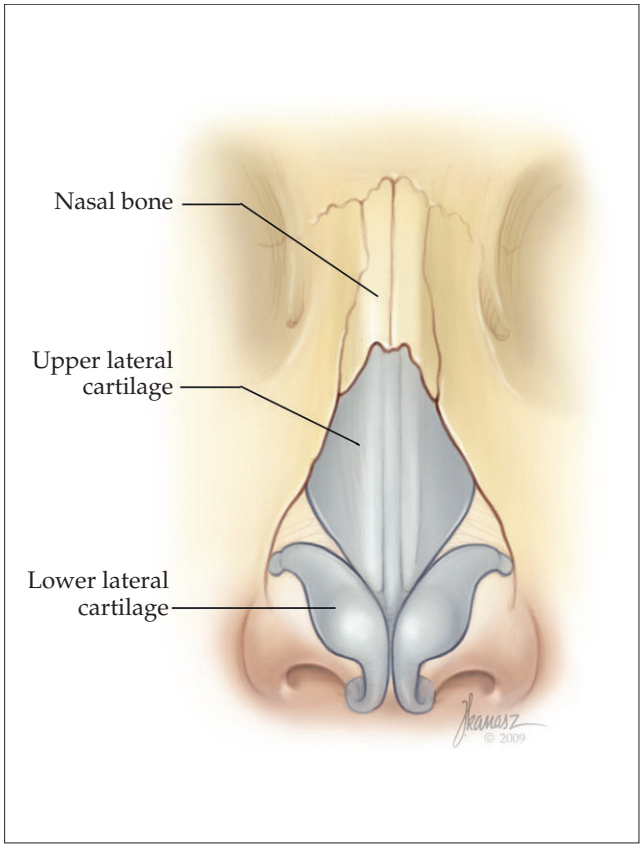

Figure 1.2 Front view of the bony and cartilaginous nasal frame.

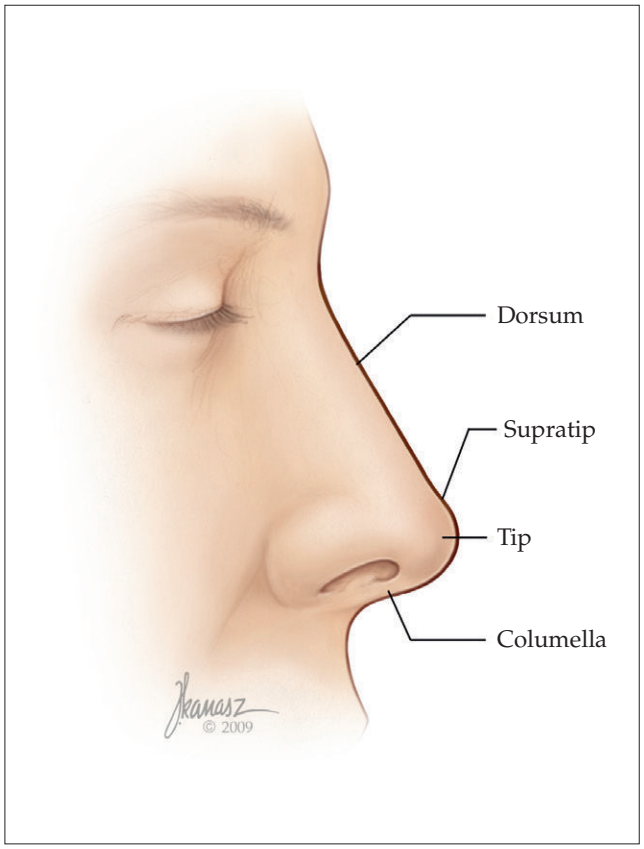

Figure 1.3 Profile view of the different anatomical components of the nose.

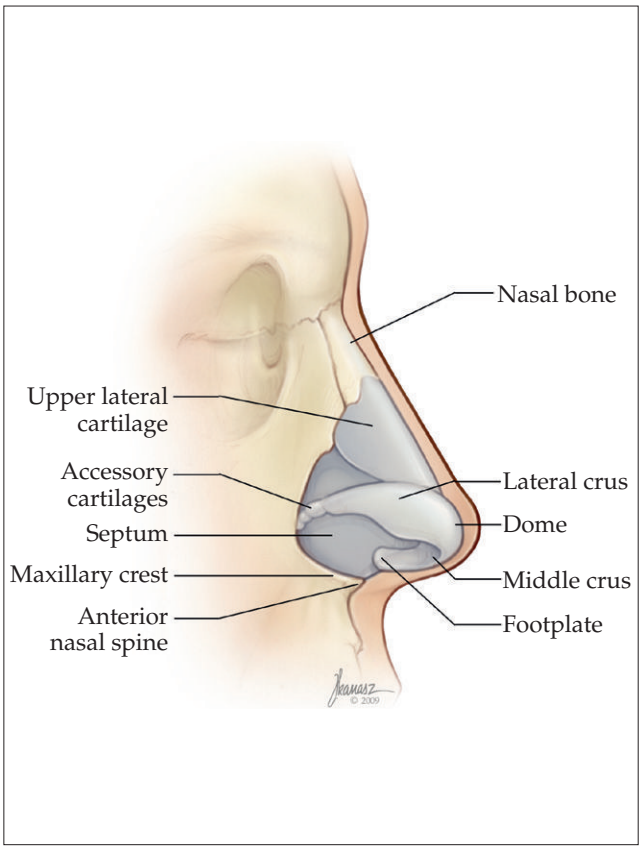

Figure 1.4 Profile view of the bony and cartilaginous nasal frame.

- *Columella* – the column between the nostrils at the base of the nose
- *Columellar-lobular angle* – the angle between the infratip lobule and the columella
- *Dorsum* – the anterior surface of the nose between the tip and the radix (Figure 1.5)
- *External nasal valve* – the external opening of the nostril
- *Hemitransfixion incision* – an incision through only one side of the membranous septum
- *Infratip lobule* – the portion of the tip between the tip defining points and the columellar-lobular junction
- *Intercartilaginous incision* – an internal incision placed at the junction of the upper lateral cartilage with the lateral crus of the lower lateral cartilage
- *Internal nasal valve* – the area located between the caudal edge of the upper lateral cartilage and the nasal septum

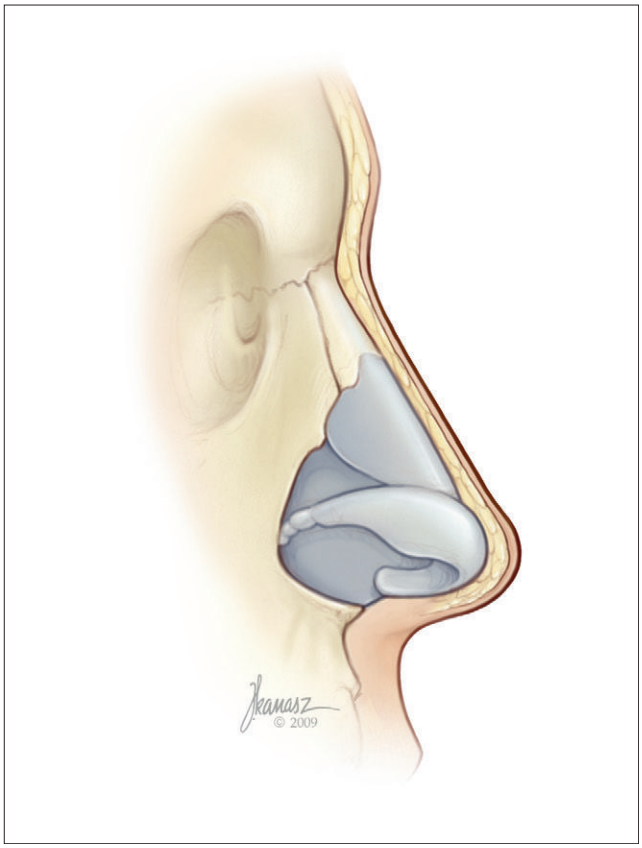

Figure 1.5 The average skin thickness is greatest (1.25 mm) at the radix and least at the rhinion.

- *Keystone area* – the junction of the perpendicular plate of the ethmoid with the septal cartilage at the dorsum of the nose
- *Limen vestibuli* – the junction of the caudal edge of the upper lateral cartilage with the cephalic margin of the lateral crus of the lower lateral cartilage
- *Lower lateral cartilages* – the paired caudal nasal cartilages consisting of the medial, middle, and lateral crura
- *Marginal or infracartilaginous incision* – an incision placed along the caudal border of the medial and lateral crura
- *Footplate of the medial crura* – the posterior segment of the medial crura that extends laterally
- *Nasal lobule* – the caudal part of the nose bounded posteriorly by the anterior nostril edge, superiorly by the supratip area, and laterally by the alar grooves
- *Nasal pyramid* – part of the nasal frame made up of the bilateral nasal bone and frontal process of the maxilla
- *Nasion* – the depression at the junction of the nose with the forehead

- *Nasolabial angle* – the angle formed by a line drawn through the most anterior to the most posterior point of the nostril intersecting the vertical facial plane on the lateral view (desired angle is 94–97° in males and 97-100° in females)[36]
- *Nostril sill* – the horizontal ridge between the columellar base and the alar base
- *Pyriform aperture* – the pear-shaped external bony opening of the nasal cavity
- *Radix* – the junction between the frontal bone and the nasal bones
- *Rhinion* – the point located at the osseocartilaginous junction over the dorsum of the nose
- *Rim incision* – an incision placed just within the vestibular edge of the rim of the naris
- *Scroll area* – the interlocking, curled junction between the lateral crus of the lower lateral cartilage and the upper lateral cartilage
- *Sesamoid cartilages* – small cartilages found in the lateral space between the upper and lower lateral cartilages
- *Soft triangle* – the thin skin fold between the anterior portion of the nostril and the caudal border of the dome between the medial and lateral crura
- *Subnasale* – the junction of the columella with the lip
- *Supra-alar crease* – the groove immediately cephalad to the alar crease
- *Supratip area* – the area just cephalad to the nasal tip at the caudal portion of the nasal dorsum
- *Tip* – The most anterior point of the lobule
- *Tip defining points (TDP)* – the most projecting area on each side of the tip that produces an external light reflection
- *Tip projection* – the distance from the most projected portion of the tip to the most posterior point of the nasal–cheek junction
- *Tip rotation* – movement of the tip cephalad or caudad pivoted at the alar base on the profile view
- *Transfixion incision* – an incision in the membranous septum between the caudal border of the septal cartilage and the columella
- *Upper lateral cartilages* – the paired cephalad nasal cartilages spanning laterally from the anterior septum and composing the lateral walls of the middle third of the nose
- *Weak triangle (converse)* – the area immediately cephalad to the paired domes

Soft Tissues of the Nose

The tissues covering the nasal frame vary significantly in thickness from the cephalic to the caudal portion. These tissues are thick cephalically and caudally, and become thinner in the center. It is for this reason that a nose frame that is totally straight on profile most likely will not induce an optimal dorsal outline. The soft tissue components of the nose include skin, muscles, nerves, and the vascular elements. In general, the nose has more sebaceous glands than most other parts of the face and body. Therefore the skin of the nose will re-epithelialize faster than other types of skin following procedures such as dermabrasion, chemical peel, and laser abrasion. The sebaceous glands are more abundant in the caudal third of the nose skin than the middle and cephalic portions. The thickness of the cephalic portion of the nose skin is related more to components such as the procerus muscle and adipose tissue than to a thick dermis and sebaceous glands.

Skin

One of the key determining factors in the outcome of the rhinoplasty is the quality of the nasal skin. The skin color, consistency, thickness, and porous nature vary from patient to patient, on different parts of the same patient's nose and at different stages of life. The skin is thicker at the radix than the central portion. However, in some patients the supratip area is even thicker than the radix and contains more sebaceous glands. Lessard & Daniel have determined that the average skin thickness is greatest at the radix (measuring 1.25 mm) and the least at the rhinion (approaching 0.6 mm) (Figure 1.5).[1]

The lower third of the nose, especially the supratip area, has an abundance of sebaceous glands which range in activity from time to time and race to race. In men, especially teenagers, there is a vast number of these glands within the tip and supratip area that renders achievement of an optimal tip definition difficult. A varying degree of rosacea may alter the skin surface color, causing some redness in the mid-vault area, or more commonly, in the caudal half of the nose, especially the supratip area. This redness commonly extends to the cheek area. The thickness of the skin is reduced dramatically in the columella and mid-alar area, while it thickens in the alar base area. As much as thick skin is problematic in achieving an ideal nasal definition, thin skin may also adversely affect the outcome of rhinoplasty by revealing harshness of the underlying frame and any existing iatrogenic or residual minor flaws, which would not be discernible in a patient with thicker skin.

The alar base area contains more fibrous bands, which is the reason for its rigidity. The vestibule is the cavity just inside the external nares bounded by the membranous septum and the columella medially and the side wall of the ala laterally, the latter being covered with hair (vibrissae).[2]

Soft Tissue Layers Beneath the Skin

There are four distinct layers that occupy the area between the skin and the underlying osseocartilaginous frame: the superficial musculoaponeurotic system (SMAS) as originally described by Tessier,[3] fibromuscular layer, deep fatty layer, and periosteum/perichondrium.[2] Immediately under the skin, there is a superficial fatty panniculus, which is largely occupied by adipose tissue containing some vertical fibers and septi running from the skin to the underlying SMAS.[2] This layer again is significantly thicker in the radix area, and becomes extremely thin in the mid-vault region and thickens in the supratip area. The SMAS of the nose is the continuation of the sheath that extends across the entire upper half of the face.

Under the SMAS there is a thin fibrofatty layer that divides to encase the superficial and deep muscles of the nose.[3,4] Wherever there is no muscle, these two layers join, creating a single layer.

The third layer of the nose is the deep fatty layer that separates the fibromuscular layer from the underlying nasal frame. The major superficial blood vessels and motor nerves run within it. A distinct feature of this layer is that it does not have fibrous septa and its role is to facilitate movement of the fibromuscular layer over the frame.

The fourth soft tissue layer is the periosteum over the nasal bones and the perichondrium over the cartilaginous frame. There are several fibrous connections joining the cartilages to each other, some extending from the lateral crura of the lower lateral cartilages to the upper lateral cartilages and connecting the accessory cartilages to each other. There is a fibrous band extending from one lateral crus to the opposite one in the supratip area which is called the Pitanguy ligament.[5] Additionally, there are dense fibrous bands between the caudal septum and the medial crura. There are also fibrous bands between the medial crura.

Nasal Muscles

The importance of the musculature of the nose has not been sufficiently emphasized in the literature. Because these muscles are thin and difficult to visualize, it is a challenge to consistently preserve them. The significance of these small nasal muscles is clearly evident in patients who suffer from facial paralysis. In the early stages after facial paralysis, even without a significant nasal deviation, these patients experience a notable blockage of the nasal airway on the ipsilateral side to the paralysis. After the nose shifts to the opposite side of the paralytic face, the deviation becomes conspicuous and the airway becomes more reduced. Additionally, in patients in whom the nasal muscles are iatrogenically disturbed during rhinoplasty, the result is a

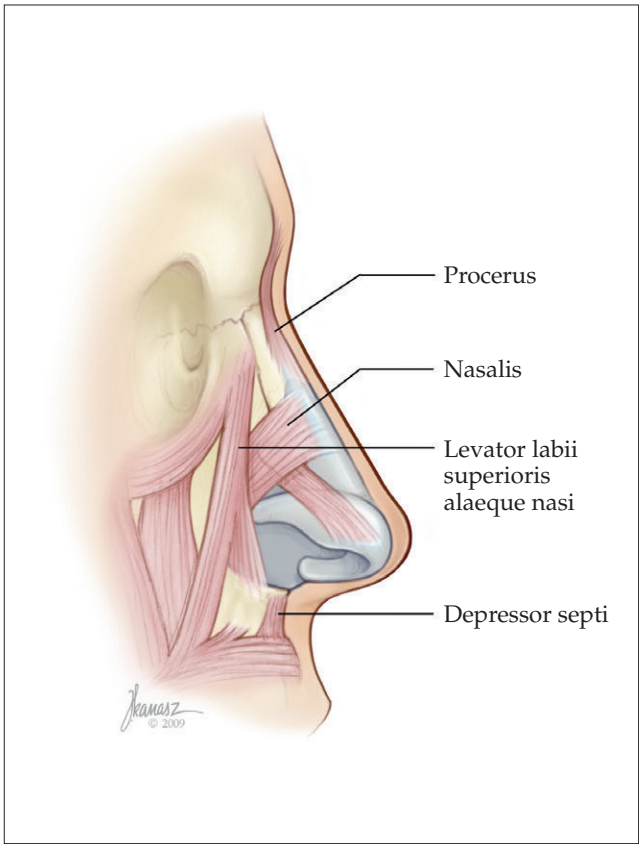

Figure 1.6 Profile view illustration depicting the nasal musculature.

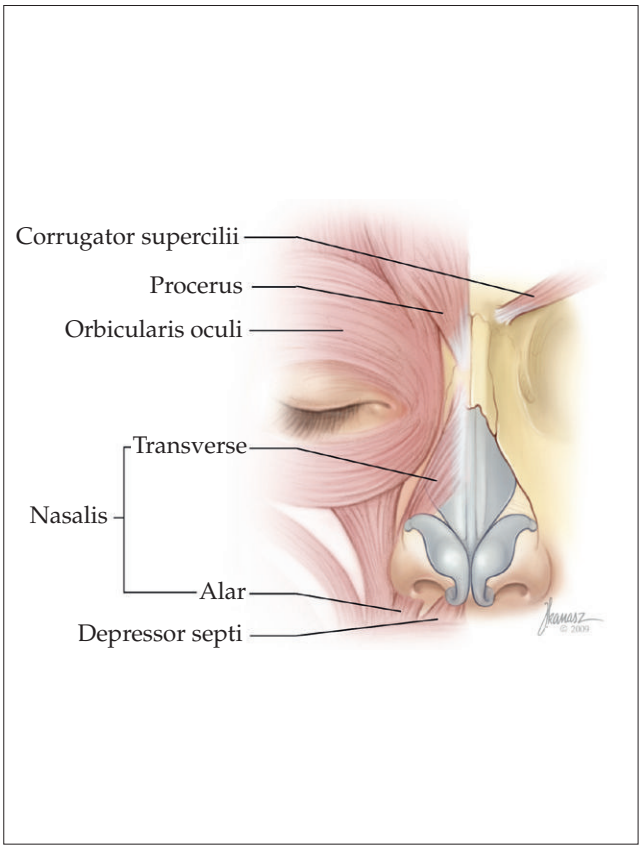

Figure 1.7 Front view illustration depicting the nasal musculature.

disconcerting functional and aesthetic change, an adverse event that is especially evident on animation. This type of muscle dysfunction is a hallmark of rhinoplasties performed several decades ago when the dissection was conducted in a supraperiosteal plane, irreparably damaging the thin nasal muscles.

The description of the muscles of the nose and explanation of their functions is one of the most confusing aspects of the body of knowledge germane to rhinoplasty. In fact, many of the articles written about the nasal musculature assign different names and functions to the same muscles of the nose. All these muscles are innervated by the VIIth cranial nerve. The following is a description of the nasal muscles and an outline of their function[6] (Figures 1.6 and 1.7).

Procerus. The most cephalic muscle of the nose is the procerus, which arises from the glabellar area, extends caudally in a vertical fashion, and joins with the wing-shaped nasalis transverse muscle covering the caudal portion of the nasal bones. The main function of the procerus is to move the eyebrows caudally; it can create wrinkles over the cephalic portion of the nose in aging patients.

Nasalis. The nasalis muscle has two components: (1) the transverse nasalis or compressor nasi and (2) the pars alaris (alar nasalis). The transverse part of the muscle spans the dorsum of the nose, covering the upper lateral cartilages. This muscle, also called pars transversa, arises from the lateral cephalic portion of the subpiriform crescent. The pars transversa joins with the procerus muscle and the opposite muscle in the midline to form the nasalis–procerus aponeurosis. The pars transversa compresses and elongates the nose, contracts the nostrils, and narrows the vestibules. Although removal of the pars transversa may shorten the nose, it is inadvisable since its removal may cause skin dimpling. Removal of the pars transversa muscle may also expose any imperfections in the frame because it eliminates the blanket effect that this muscle lends the nose. The second component of the nasalis muscle, the pars alaris (alar nasalis) arises from the crescent origin of the maxilla and is more lateral and slightly caudal to the bony origin of the depressor septi nasi muscles. The alar portion partially covers the lateral crus of the lower lateral cartilages and assists in dilatation of the nares. Damage to this muscle may result in collapse of the external nasal valve. In ethnic noses, the pars alaris is much more developed and is stronger.

Depressor Alae or Myrtiforme. This muscle originates from the border of the pyriform crest and then rises vertically, like a fan, up to the ala, acting as a depressor and constrictor of the nostrils. Release of this muscle during alar base surgery has a beneficial effect on the external valve.

Levator Labii Superior Alaeque Nasi. This is another muscle that plays an important functional role. It extends lateral to the nose in a cephalocaudal direction and has fibers that are attached to the nostril, thus contributing to the dilatation of the nares. Paralysis of these muscles will also cause collapse of the external valve.

Depressor Septi Nasi Muscle. This muscle arises from the maxilla (just below the nasal spine), sometimes fuses with some fibers of the orbicularis oris muscle, extends along the columella base, and attaches to the footplate. Occasionally, fibers of this muscle extend to the middle genu. Some believe that these muscle fibers extend to the membranous septum. The depressor septi nasi muscle depresses the nasal tip on animation and alters the air turbulence. Additionally, it has aesthetic importance since its contraction would narrow the labiocolumellar angle. Release of this muscle not only eliminates the depressor effect on the tip but may also cause slight ptosis of the upper lip, which may or may not be beneficial, depending on the patient's incisor teeth show.

Blood Supply

Both the external and internal carotid arteries provide blood supply to the external nose[7,8] (Figure 1.8). The angular artery running close to the nasofacial junction provides most of the arterial circulation to the lateral nose.

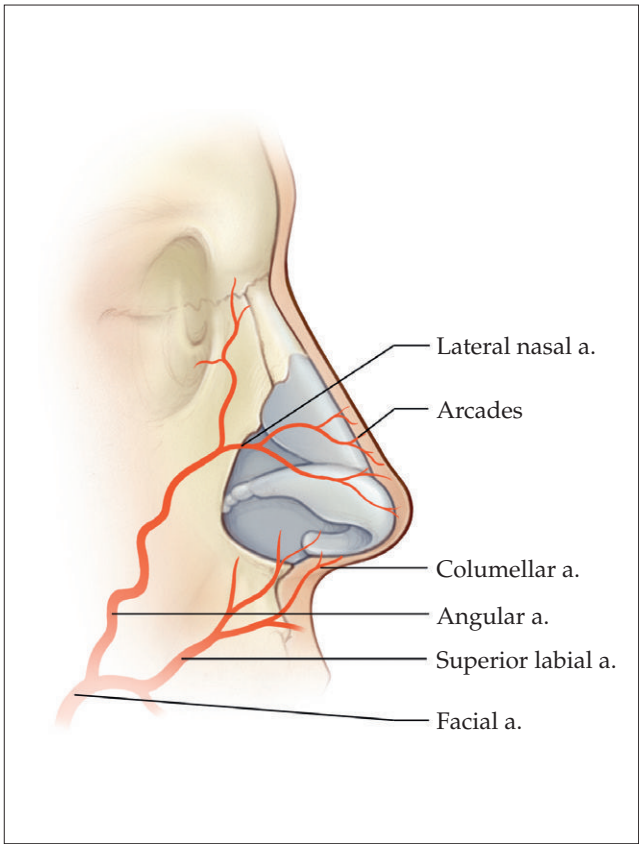

Figure 1.8 Profile view illustration depicting the arterial blood supply to the nose.

This is the terminal branch of the facial artery. An important branch that arises from the angular artery and runs towards the nasal tip is the lateral nasal artery. Branches of this artery have a watershed effect with branches of the dorsal nasal artery, which connects with the external branches of the anterior ethmoid artery. The latter branch extends towards the nasal tip. The branches of this artery also communicate with the infratrochlear artery. The lateral branches of the infraorbital artery also provide arterial circulation to the nose.

Additionally, the nose receives circulation from the superior labial artery, which branches off from the facial artery. There is a consistent branch on either side of the lip arising from the superior labial artery, which is called the columellar artery.[9–14]

The venous drainage takes place through the branches that have the same names as the associated arteries and connect to the corresponding venous system, namely through the dorsal nasal, infratrochlear, external nasal branches of the anterior ethmoid, lateral nasal, and columella veins.

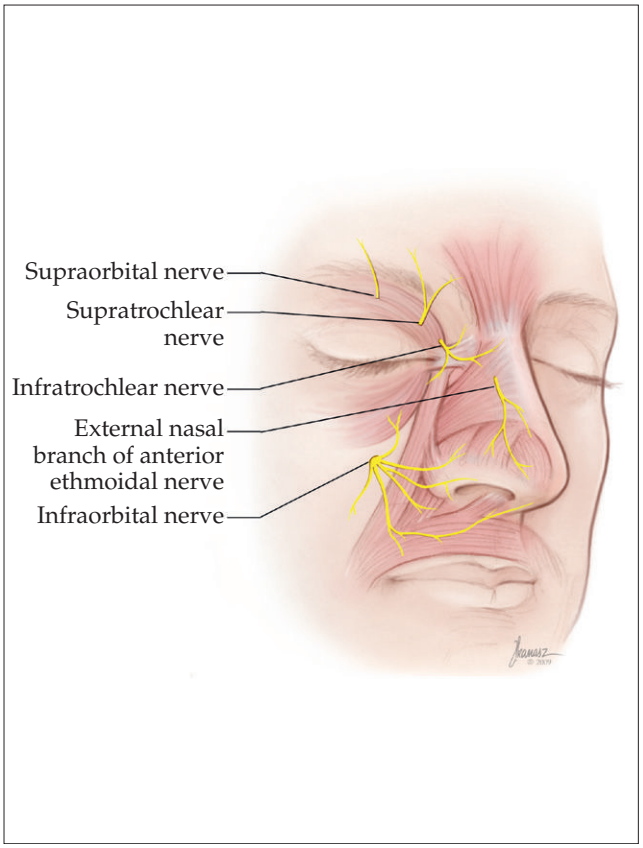

Figure 1.9 Illustration of the sensory innervation of the nose from cranial nerve V.

Sensory Nerve Supply

The maxillary and ophthalmic branches of cranial nerve V provide sensory innervation to the nose (Figure 1.9). The supraorbital and supratrochlear branches of the ophthalmic nerve supply the sensory innervation to the cephalic portion of the nose. The external nasal branch of the anterior ethmoid nerve provides innervation to the mid-vault area and extends to the tip of the nose. The infraorbital nerve provides sensory innervation to the nose posteriorly. The caudal portion of the columella is also innervated by the infraorbital nerve. This nerve also provides sensory innervation to the alar area.

External Nasal Frame

The nasal frame has two distinct components. The cephalic portion of the nose consists of bony vault and the caudal portion is cartilaginous.

Bony Vault

The bony vault is composed of a pair of nasal bones and the ascending frontal process of the maxilla. This part of the nose is pyramidal in shape, the narrowest portion being at the intercanthal line (Figure 1.4). The nasal bones become thicker cephalically, so any osteotomy above the intercanthal line may become somewhat arduous. The average length of the nasal bone is 25 mm, although it varies tremendously from person to person. There is a significant variation in the length of the nasal bones related to race.[15] African-American noses often have short nasal bones. This becomes significant in maintaining the width of the nose after nasal bone osteotomy. Osteotomy and medial repositioning of the long nasal bones will have a deleterious effect on the airway since it will transpose the upper lateral cartilage as well.[16] Any abnormalities in the width of the nasal bones can distort the aesthetic dorsal lines, causing displeasing incongruity. Restoration and maintenance of the dorsal outline is an important part of rhinoplasty.

The nasal bones join with the frontal process of the maxilla laterally. These processes are significantly thicker than the nasal bones. However, incorporation of a portion of this frontal process with the nasal bone osteotomy will ensure a better nasal definition and avoid a step deformity. The circle created between the nasal spine, the thin portion of the frontal process of the maxilla, and the thin caudal border of the nasal bones is called the pyriform aperture.[17] The nasal bones fuse with the superior edge of the perpendicular plate of the ethmoid bone cephalad to the intercanthal line. The confluence of cartilaginous nasal septum, ethmoid bone, and nasal bone is called the keystone area[18–21] (Figure 1.10). When the dorsum is lowered significantly, the keystone area is weakened and the roof of the nose becomes open. On patients with wide noses, the distance between the nasal bones and the perpendicular plate is fairly significant, especially following removal of a large hump, necessitating removal of a wedge between the nasal bones and the perpendicular plate to facilitate medial transposition of the bones, without which the nasal bones may not readily move medially.

Cartilaginous Nasal Frame

The cartilaginous nasal frame consists of a pair of upper and lower lateral cartilages.

Upper Lateral Cartilages

The upper lateral cartilages are a pair of rectangular cartilages that support the lateral nasal walls. These cartilages join the septum in the midline, although the fusion between the upper lateral cartilages and the septum occurs in such a way that it almost creates a single unit cephalically.[22] The lateral border of the upper lateral cartilages frequently terminates at the level of the lateral nasal bone suture line. This leaves a space between the bone and upper lateral

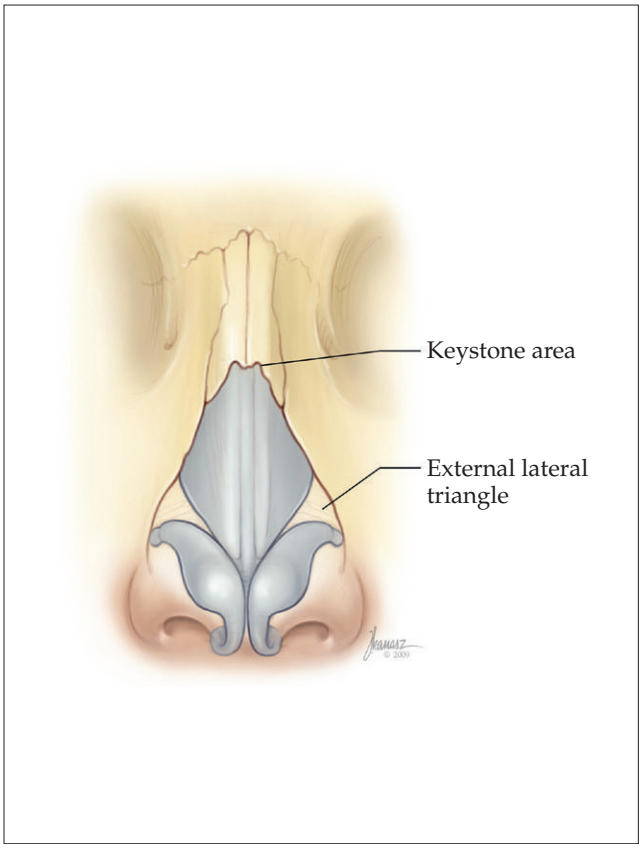

Figure 1.10 The confluence of cartilaginous nasal septum, ethmoid bone, and nasal bone is called the keystone area. The space referred to as the external lateral triangle is surrounded by the caudal border of the upper lateral cartilages cephalically, the frontal process of the maxilla laterally, and the cephalic border of the lower lateral cartilage caudally.

cartilage, which is called external lateral triangle and is surrounded by the caudal border of the upper lateral cartilages cephalically, the frontal process of the maxilla laterally and the cephalic border of the lower lateral cartilage caudally (Figure 1.10). The mucoperiosteum covering the septum extends underneath the upper lateral cartilage (Figure 1.11). The angle between the caudal border of the upper lateral cartilage and the septum, which is usually 10–15° (Figure 1.12), constitutes the internal valve (Figure 1.13) along with the border of the inferior turbinates. The cephalic portion of the upper lateral cartilage is overlapped by the nasal bone (Figure 1.14). The amount of overlap is highly variable and can range from 2–11 mm.[23]

Lower Lateral Cartilages

The lower lateral cartilages have four components: the medial crus, middle crus, lateral crus, and dome.

Medial Crus. The medial crus has two distinct segments: the footplate and the columella. The footplate varies in size and in the degree of lateral angulation. This angulation of the footplate governs the width of the base of the columella. The posterior portion of caudal septum influences the footplate and may cause distortion of the columella base. Correction of this abnormality may require repositioning of the septum as well as the footplate. As the lateral angulation is corrected, it will advance the base of the columella caudally.[24]

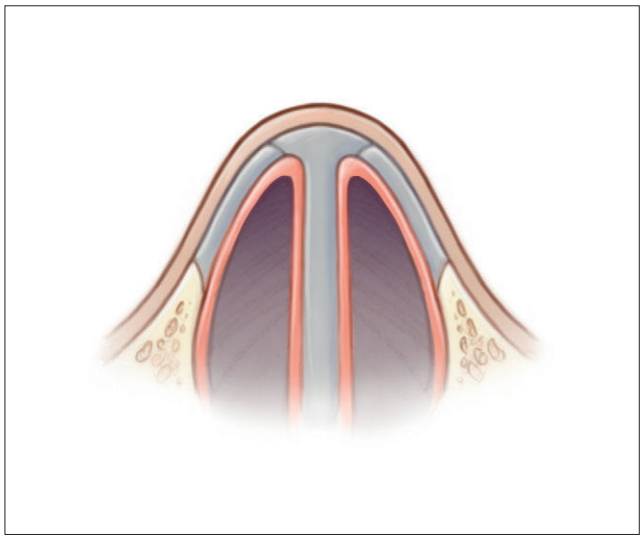

Figure 1.11 The mucoperiosteum covering the septum extends underneath the upper lateral cartilage.

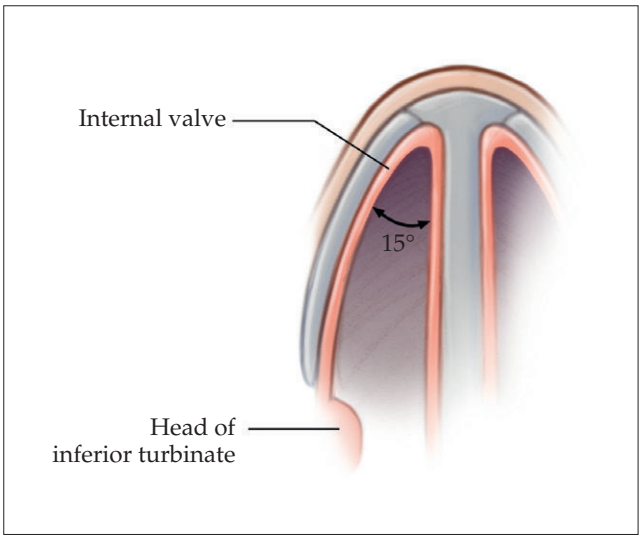

Figure 1.12 The angle between the caudal border of the upper lateral cartilage and the septum, usually 10–15°, comprises the internal valve along with the border of the inferior turbinates.

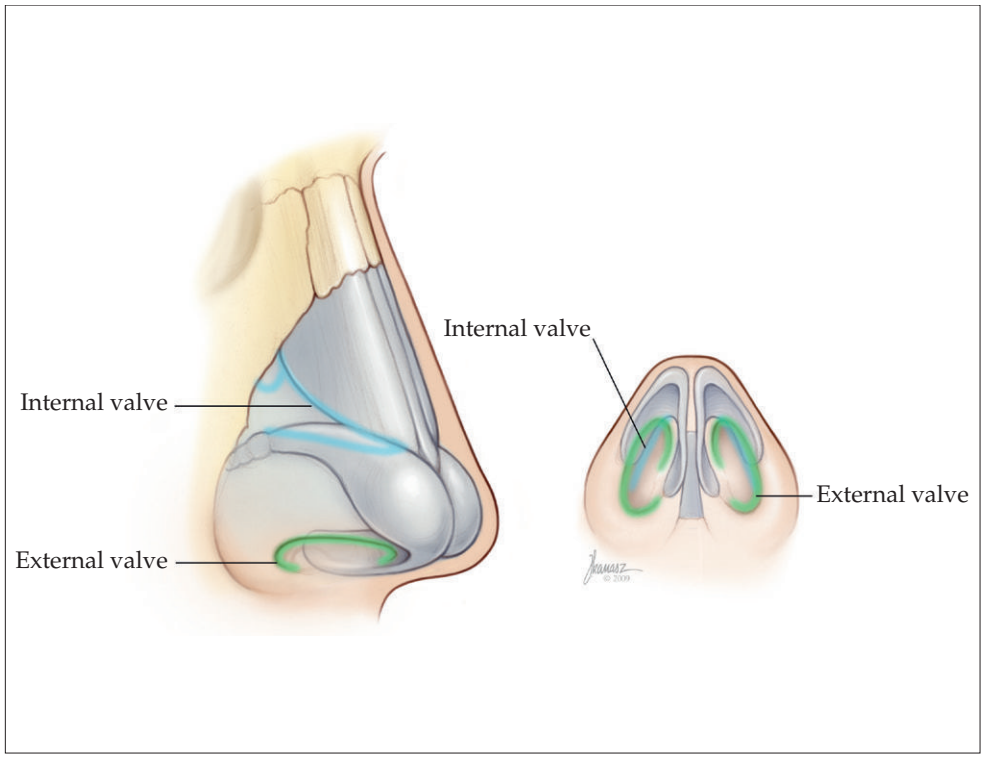

Figure 1.13 Relationship between the internal and external valves.

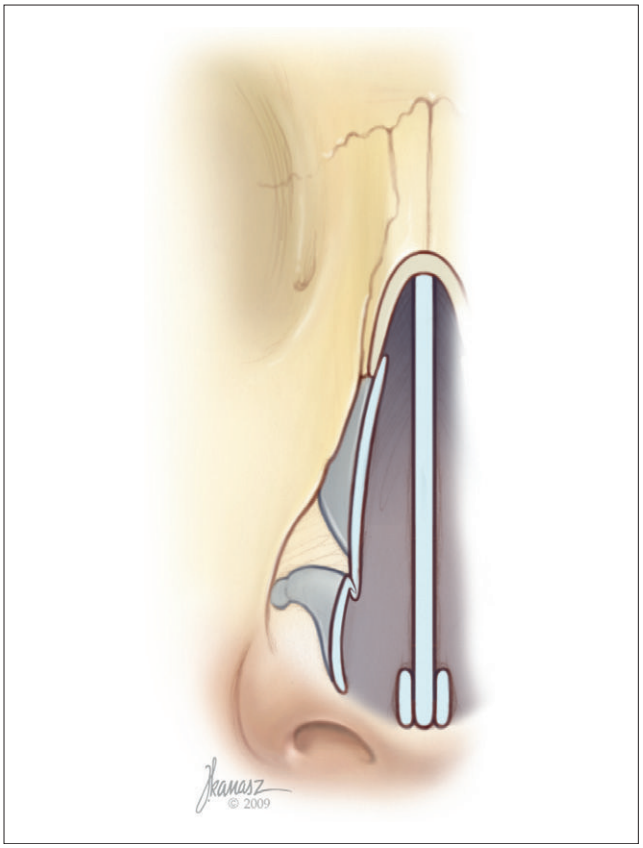

Figure 1.14 The cephalic portion of the upper lateral cartilage is overlapped by the nasal bone. The amount of overlap is highly variable and can range from 2–11 mm.

The columellar segment of the medial crus varies in length and width. The longer the columella portion, the longer the nostril and thus a potentially more projected nasal tip. Cephalad to this portion of the medial crura is the membranous septum, which is composed of two layers of soft tissues encasing some fibrous bands called septocolumellar ligaments.

Middle Crus. This part of the lower lateral cartilage extends between the medial crus and the domes. The configuration of the infratip lobule is largely controlled by the length and width of this segment of the lower lateral cartilage.

Dome. The domal segment is the narrowest and thinnest portion of the lower lateral cartilage, yet is the most important in relation to the tip shape. There is a tremendous variation in its shape. On rare occasions, it has a convolution that, when present, invariably results in bulbosity of the tip. The area posterior and caudal to the domes between the medial and lateral segments contains two pieces of soft tissue, with no cartilage, is externally covered with skin and internally with the vestibular lining, and is called the soft triangle. The cephalic edges of the paradomal segments are frequently in close approximation in the optimal nose and the caudal portions are divergent. Whenever the cephalic margins diverge, they result in widening of the nasal tip.

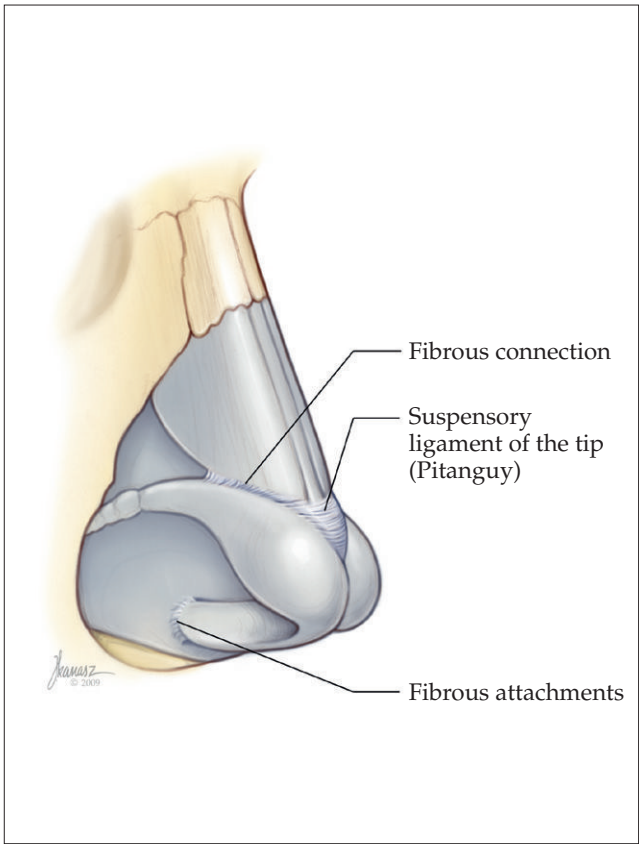

Figure 1.15 The medial and middle crura are tightly bound together by fibrous bands. The most anterior one is called the interdomal ligament. Additionally, there are fibrous bands more anteriorly, binding the domes to each other and the overlying dermis, which are called Pitanguy ligament. There are additional fibrous bands at the level of the footplates and between the upper and lower lateral cartilages.

The medial and middle crura are tightly bound together by fibrous bands. The most anterior one is called the interdomal ligament. Additionally, there are fibrous bands more anteriorly binding the domes to each other and the overlying dermis; these are called the Pitanguy ligament[5] (Figure 1.15). There are additional fibrous bands at the level of the footplates and between the upper and lower lateral cartilages. Overall, these two paired middle and medial crura structures constitute the caudal leg of the tripod. The other two legs of the tripod are the lateral crura of the lower lateral cartilages (Figure 1.16).

Lateral Crus. This portion of the nasal lobule is the largest component. It is narrow anteriorly but becomes wider in the mid-portion and narrows again laterally. The lateral crus of the lower lateral cartilage (LLC) is usually in contact with the first chain of the accessory cartilages that abut the pyriform aperture.[25] Medially, the lateral crus is continuous with the domal segment. The anterior portion of this cartilage can curve in a variety of directions and controls the convexity of the ala. It also provides support to the anterior half of the alar rim. However, posteriorly it diverges and does not have much contribution to the ala, yet does contribute to the function of the external valve (Figure 1.13). Generally, this cartilage is oriented at a 45° angle to the vertical facial plane. Any narrowing between the dorsum and the long axis

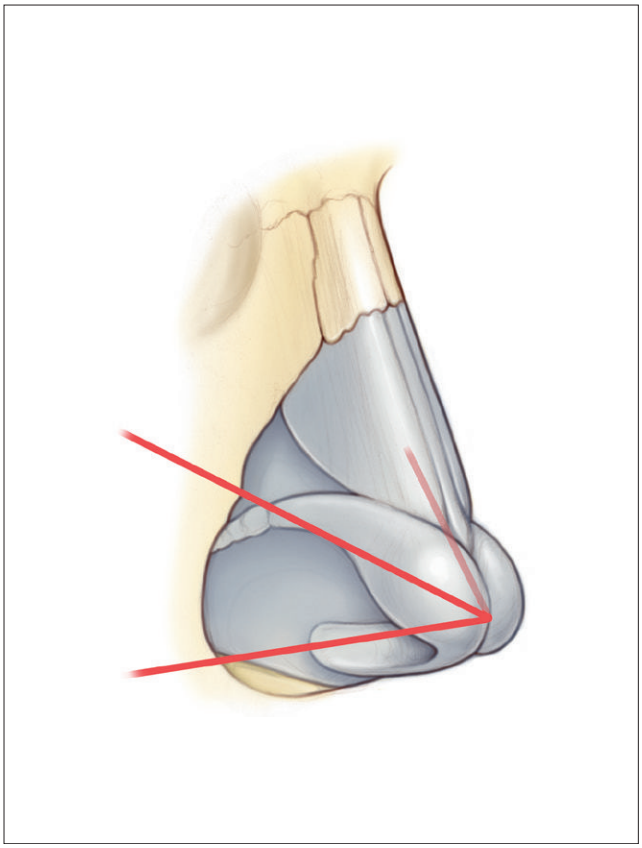

Figure 1.16 Overall, these two paired middle and medial crura structures constitute the caudal leg of the tripod. The other two legs of the tripod are the lateral crura of the lower lateral cartilages

of the lower lateral cartilage may cause dysmorphology of the tip, called cephalic malposition or 'paranthesis deformity', a term coined by Jack Sheen.[26]

The curled junction of the cephalic edge of the lateral crus and the caudal edge of the upper lateral cartilage is referred to as the scroll area. The magnitude of curling can vary from patient to patient and is sometimes significant enough to cause external visibility and fullness in this area. The lower lateral cartilage is commonly short and weak in non-Caucasian noses.[27]

Internal Anatomy of the Nose

The septum divides the nose into two internal nasal spaces, laterally confined with the lateral wall of the nose and medially with the septum. The roof of this cavity is cartilaginous caudally and bony cephalically. The bony floor is made up of the palatine process of the maxilla anteriorly and the horizontal plate of the palatine bone posteriorly. The medial wall of the antrum constitutes the lateral wall of the nasal cavity. There are thin, curved, bony prominences in the lateral wall called the inferior, middle, and superior concha. The cephalic portion of the lateral nasal wall is bound with the ethmoid cells, interposed between the lateral wall of the nasal cavity and the medial wall of the orbit. Superiorly, the nasal lining consists of olfactory mucous membrane which has a yellowish hue.[2]

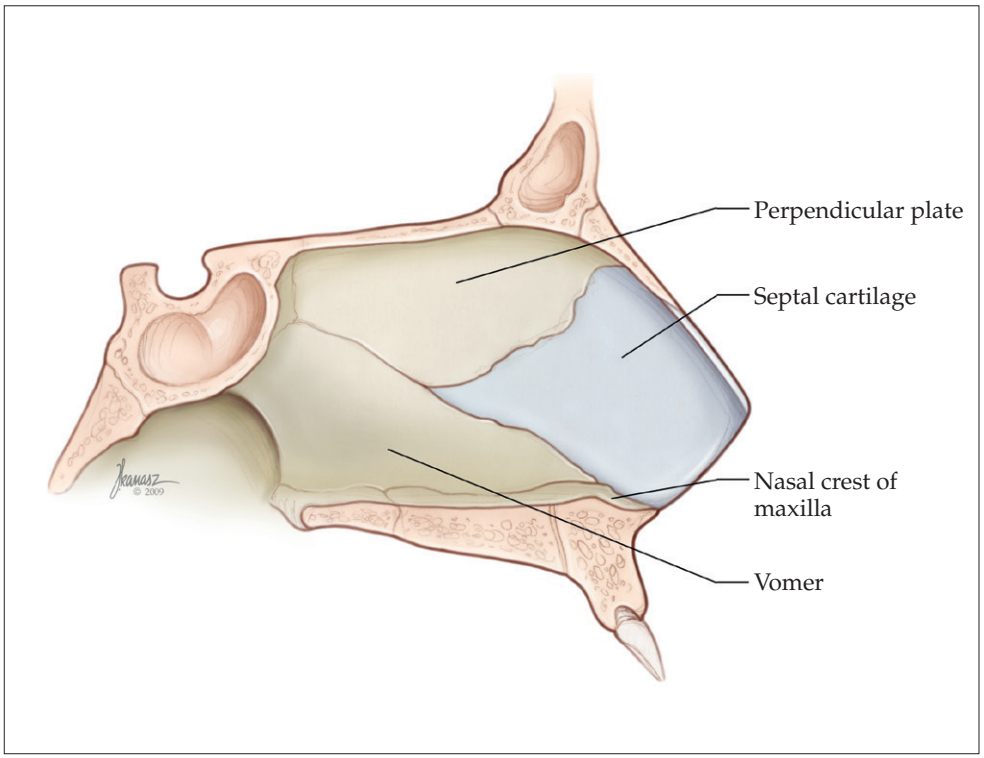

Figure 1.17 The nasal septum is bony cephalically and cartilaginous and membranous caudally. The bony portion includes the perpendicular plate of the ethmoid bone, the ethmoid, the vomer, and the maxillary crest (nasal crest of maxilla).

Nasal Septum

The nasal septum is bony cephalically and cartilaginous and membranous caudally (Figure 1.17). The bony portion includes the perpendicular plate of the ethmoid bone, the ethmoid, the vomer, and the maxillary crest (nasal crest of maxilla). The perpendicular plate forms the upper third of the bony septum and is continuous with the frontal bone and the cribriform plate. Anteriorly, this bone joins the nasal bones in the midline, caudally it is in contact with the cartilaginous septum, and inferoposteriorly it is in continuity with the vomer bone. The junction of the perpendicular plate and the cartilaginous septum over the dorsum of the nose is referred to as the keystone area.

The vomer bone is shaped like the keel of a boat and extends from the sphenoid bone superiorly to the nasal crest of the palatine bones and maxilla, joining the premaxillary wings of the maxilla. The most projected caudal portion of the premaxilla is the anterior nasal spine. This is quite underdeveloped in non-Caucasians and non-existent in patients with Binder's syndrome. The bony groove that supports the septal cartilage is deep caudally and anteriorly and gradually becomes flatter as it extends posteriorly.

The septal cartilage, which is also called the quadrilateral cartilage, is flat and varies in size and shape. The cartilage connects with the perpendicular plate

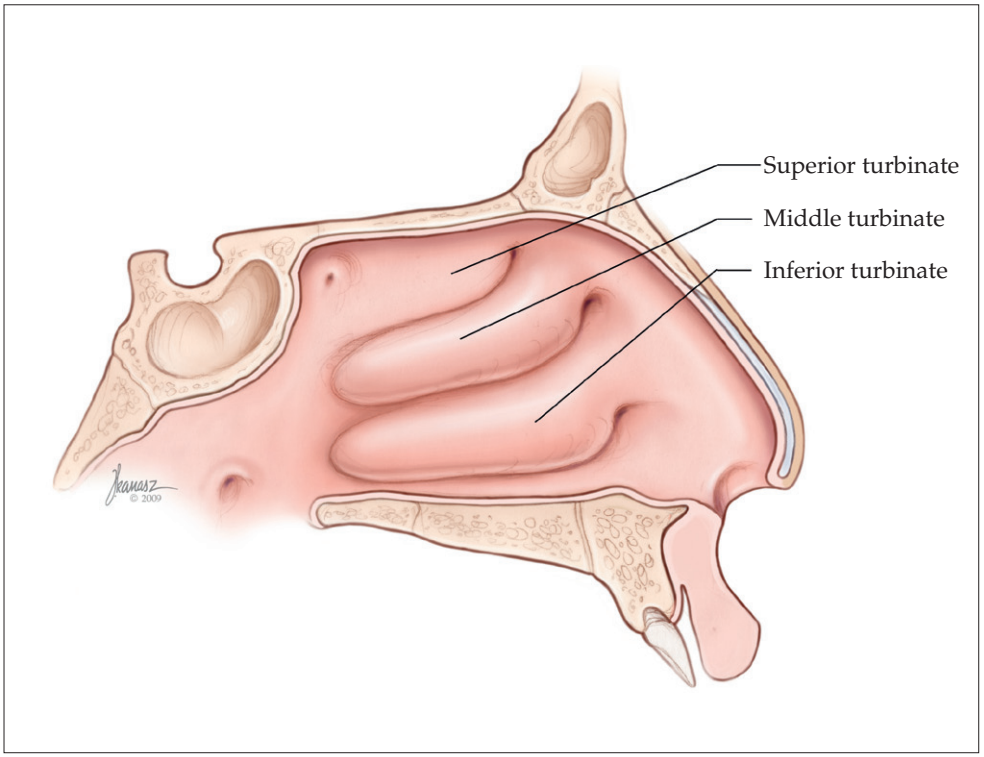

Figure 1.18 There are three turbinates along the lateral walls of the nasal cavity, the superior, middle, and inferior turbinates. The turbinates are covered with mucosa containing a fair number of veins, which allows them to become engorged. Caudal to each turbinate is the opening of the sinuses.

of the ethmoid posteriorly and fuses with the vomer bone and premaxillary wings. The junction between the dorsal and caudal portion of this cartilage is called the anterior septal angle. Continuous interweaving of the perichondrium and the periosteum at the junction of the vomer bone and the cartilaginous septum anteriorly makes dissection in this part very difficult. Thus, it is easier to dissect the mucoperiosteum posteriorly and extend the dissection anteriorly during a septoplasty.

Lateral Walls of the Nasal Cavity

There are three turbinates along the lateral walls of the nasal cavity, which are the superior, middle, and inferior turbinates (Figure 1.18). They are covered with mucosa containing a fair number of veins, allowing them to become engorged. When the septum deviates to one side, the inferior and middle turbinates especially have a tendency to compensate and follow the septum. Therefore, any attempt to reposition the septum should be in conjunction with reduction of the enlarged turbinate. Caudal to each turbinate is the opening of the sinuses.

The majority of the sensory innervation to the posterior portion of the nasal cavity is through the pterygopalatine (sphenopalatine) ganglion of the

maxillary division of the trigeminal nerve. In the pterygopalatine fossa, running just lateral to the posterior aspect of the lateral nasal cavity, the maxillary nerve gives off two pterygopalatine nerves that pass downward towards the ganglion. Most of the branches then pass through the sphenopalatine foramen located just behind the posterior end of the middle turbinate. The first branches are lateral, posterior, superior branches, which provide sensation to the superior and middle turbinate. Branches also cross medially in the roof of the nose to pass obliquely down the septum as medial posterior branches.[7] The middle branches eventually become consolidated into the nasopalatine nerve, which passes forward on either side of the septum to the incisive canal to anastomose with the terminal branch of the greater palatine nerve. There are also lateral, posterior, superior branches that come off the greater palatine nerve as it descends in the palatine canal and provide sensation to the lower part of the lateral wall of the nose, including the inferior turbinate. The nasociliary nerve from the ophthalmic branch of the first division also provides sensory innervation to the nose. One of the terminal branches of this nerve, which is called the anterior ethmoid nerve, exits the skull through the anterior ethmoid foramen accompanying the anterior ethmoidal artery, then runs along the lateral margin of the ethmoid plate, and passes into the nose through the ethmoid slit at the site of the crista galii.[7] The lateral ethmoid nerve forms the lateral and medial internal nasal branches. The lateral branch supplies the area anterior to the superior concha and above the middle concha as well as the anterior end of the middle and inferior turbinates.

The arterial supply of the internal nose is provided by the internal and external carotid artery system. The branches of the internal carotid artery are the anterior and posterior ethmoidal arteries, which are branches of the ophthalmic artery within the orbit. The larger anterior ethmoidal branch supplies the anterior third of the lateral wall of the nose and the corresponding area of the septum. The terminal branches of these arteries anastomose with the branches of the maxillary artery, including the sphenopalatine artery and the angular branches of the facial artery laterally, and the septal branches of the superior labial artery medially. The terminal branches of the anterior ethmoidal artery accompany the external nasal branch of the anterior ethmoid nerve, passing between the nasal bone and upper lateral cartilages, and supply the soft tissues of the dorsum and the tip of the nose. The posterior ethmoidal branches supply the smaller area above the superior concha on the lateral wall and a corresponding area high on the septum.[2] The external carotid artery also sends branches to the nasal cavity.

The sphenopalatine branch of the maxillary artery enters the nose along the posterior superior nasal nerves through the pterygopalatine foramen. It then divides into lateral branches that supply the major portion of the concha, the two largest running along the middle and inferior concha. Additional branches of the posterior septal artery cross the inferior surface of the

sphenoid bones and supply the posterior two thirds of the septum. Another branch of the maxillary artery is the descending palatine artery, which provides branches as it descends in the palatine canal in the lateral wall of the nose, along with the greater palatine nerve. After passing through the palatine foramen and passing along the inferior surface of the hard palate, the terminal branches of both the greater palatine arteries pass upward through the incisive foramen to supply the lower part of the nasal cavity on either side of the septum and nasal floor. Another branch of the external carotid, the facial artery, also contributes to the internal nasal blood supply both medially and laterally. Medially the superior labial branch of the facial artery sends a branch into the vestibule that continues to supply the anterior septal area. The smaller branches of the angular artery pass through the alar sidewalls and enter the vestibule.

The highly vascular area that receives arterial circulation from the superficial terminal branches of the anterior ethmoid, the sphenopalatine, and the superior labial arteries is called Kesselbach's plexus.[7,28,29] This is a common source of anterior nasal bleed because of the robust blood flow.

The internal nose veins drain into the branches corresponding to the previously mentioned arterial blood supply. The veins pass through the pterygopalatine foramen into the pharyngeal plexus and via ethmoid branches into the cavernous sinus. The external nasal vein drains into the facial and jugular venous system.

Anteriorly, the nasal lymphatics drain through the soft tissue nares and into the lymphatics of the upper lip. Posteriorly, they are larger and more prevalent and some drain towards the deep cervical lymph nodes. The majority, however, pass in front of the eustachian tube, where they join the lymphatics from the upper pharynx and the middle ear to pass into the retropharyngeal space.[7,8,30]

Nasal Physiology

Nasal physiology is complex, intriguing, dynamic, and essential to the quality of life. The nose functions as a conduit for oxygenated air and acts as a mechanism for warming the air that flows into the lungs, as well as acting as a humidifier and an olfactory system. The regulatory capacity of the nose is both fascinating and perplexing. Nasal breathing is the sole physiologic mechanism of ventilation, disturbance of which can lead to mouth breathing and consequential dryness of the lower respiratory tract, which can result in disease conditions such as pharyngitis, asthma, bronchial hypertrophy, bronchitis, and laryngitis. Obstructions to nasal breathing can be caused by structural abnormalities such as septal deviation, hypertrophied turbinates, nasal valve incompetence, or intranasal masses, all of which increase nasal resistance and thus decrease nasal airflow.[31] Of these, the internal nasal valve is considered the most common cause of nasal airway obstruction.

The nose is capable of providing warmed air into the lungs with a constant temperature of 31–34°C.[32] Additionally, the nose provides 90–95% humidification to the inspired air. Both humidification and temperature regulation undergo swift changes in different parts of the nose. It is in the region of the limen nasi that the air is slowed and separated into two streams. The main stream is directed to the floor of the nose. The smaller stream is directed upwards and sweeps over the dorsum of the inferior nasal turbinate. At this point, the air is warmed and continues to move upward. Upon reaching the head of the middle turbinate, the upward draft splits into a lateral stream that ventilates the paranasal sinuses and a medial stream that is directed upward. The alignment of the middle turbinate is crucial for ventilation of the olfactory groove.

Additionally, the nose functions as a filter and perhaps the front line of defense working with the immune system. There is a combination of macrophil, mast cell, and granulocyte activity as well as mechanisms that are not very specific and perhaps not yet clearly defined. Approximately 85–90% of particulate matter greater than or equal to 5 μm is deposited along the nasal cavity by the time the airflow reaches the posterior nasopharynx.[33] The mucus produced by the epithelial cells in the conducting layers forms a layer called the mucociliary blanket. The mucociliary blanket produces a positive electrostatic charge on the nasal cavity walls. Negatively charged foreign particles that are inspired are attracted to the nasal walls and are thus prevented from traveling further distally to more sensitive areas of the respiratory tract. Larger particles can become trapped within the vibrissae found just within the nasal vestibule. The cilia, which are constantly in motion, move the mucociliary blanket with its entrapped particles in an escalator-like fashion towards the oropharynx, where it is subsequently swallowed or expectorated.

The optimal turbulence of the nose will occur with a nasolabial angle of 90–115°. An obtuse angle will lead the air directly to the nasal pharynx, while a narrower angle will result in airflow into the cephalic nose. Any abnormal airflow can result in stagnation of secretions in certain parts of the nose, which ultimately may result in foci of infection, localized bleeding, and foul odor.

The olfactory role of the nose has not been emphasized sufficiently in the aesthetic rhinoplasty literature. The area of respiratory epithelium located in the hemiolfactory groove measures approximately 2 × 5 cm.[34] There are approximately 10 million olfactory cells in the human nose. These are bipolar sensory cells with an elongated cell body and short process with numerous cilia that extend into the nasal mucous spine.[34] The axons are at the opposite end of the cells and pass through the basal membrane of the olfactory epithelium and join to form fila olfactoria. These filaments pass through the cribriform plate to enter the olfactory bulb in the brain. The information is relayed through the olfactory tract to the olfactory cortex, thalamus, hypothalamus, and amygdala.

Respiratory hyposmia can result from obstruction or deficient aeration of the olfactory groove caused, for example, by septal deviation, polyps, or tumors, and deformities of the nasal turbinates (lateralization, atrophy, paradoxical curvature).

The vomeronasal organ is a crescent-shaped organ that is enclosed in a separate bony or cartilaginous capsule opening into the base of the nasal cavity. It is split into two pairs separated by the nasal septum. The vomeronasal organ is mainly used to detect pheromones (chemical messengers that carry information between individuals of the same species) and has been shown to play an important role in the reproduction and social behavior of many species. The presence of this structure in adult human beings is debated. However, endoscopic and microscopic investigations have suggested that there is a vomeronasal organ on at least one side in most adults.[35] Nevertheless, its functionality in humans is widely controversial, as there do not appear to be any neural connections between any sensory receptor cells existing in the adult human vomeronasal organ and the brain.

One of the secondary functions of the nose is the role it plays in voice quality. The quality of our voice depends on the resonance of air through the mouth, pharynx, and nose. One of the commonly asked questions by patients is whether nasal surgery will alter the sound of their voice. Although this consequence cannot be ruled out, postsurgical changes in voice quality have not been substantiated.

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CHAPTER 2

Patient Assessment for Rhinoplasty

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Pearls

- While knowledge of a positive history of excessive bleeding during a previous nose or other surgery is very helpful, lack of such a history does not exclude the potential for bleeding disorders during the upcoming rhinoplasty.
- One of the most important requirements for the success of any cosmetic surgery, especially rhinoplasty, is full understanding of the patient's concerns and having matching objectives between the surgeon and the patient.
- A large number of patients may state that they do not have any breathing problems; however, keen observation may reveal that their lips are apart and they are complete or partial mouth-breathers.
- If the nature of an underlying airway compromise is not detected and corrected, a reduction rhinoplasty may result in deterioration of the underlying condition.

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- Over 60% of patients who have migraine headaches have a rhinogenic trigger site.
- Rhinogenic migraine headaches usually start from an area behind the eyes, the patient often wakes up with a headache in the middle of the night or early morning, and the headaches are commonly triggered by changes in the atmospheric pressure.
- Patients who have daily migraine or sinus headaches have contact points between the septum and turbinates or have concha bullosa.
- An overprojected nose and prominent chin create an enigma. Reduction of one structure may actually exaggerate the disharmony of the other.
- Since the nose is harmonized with the other facial structures, detection of other facial disharmonies is of paramount importance in achieving a successful outcome.
- The smile view can reveal a horizontal line on the upper lip, result in significant widening and cephalic distraction of the ala, clearly demonstrating the deviation of the nose, and prove hyperactivity of the depressor nasi septi muscle causing the tip to rotate towards the lip.
- The base of the ala is located 2 mm cephalad to the junction of the upper 2/3 and lower 1/3 of the distance from the medial canthus to the stomion.
- Proper patient selection for plastic surgery is not about diagnosing psychological disorders, since we, as plastic surgeons, are not qualified to make such a diagnosis. The skill lies in avoiding hasty surgery on patients who may be displeased with the rhinoplasty no matter how good the outcome is.
- Merely declining the surgery and failing to facilitate psychological advice when appropriate, will invariably result in the patient finding a different surgeon who will offer surgery, and an unhappy outcome will ensue.
- Statements such as 'I would like my nose to look the way it did prior to the last rhinoplasty' made by someone undergoing a secondary procedure should alert the surgeon.
- Comparing the patient's and the surgeon's assessments, on a scale of 1–10, of the magnitude of concern with the nose may help in ensuring that there is parity in understanding of the dysmorphology.
- A narrow and higher vaulted palate with posterior dental cross bite usually is an indication of a narrow maxilla and a very limited nasal airway, whereby a reduction rhinoplasty may further sacrifice the nasal air flow.
- A tip that is hanging from a large hump is destined to lose a good portion of its projection immediately upon lowering the caudal dorsum.
- Many patients who have deviated noses pluck their eyebrows differentially to camouflage the nasal deviation. Using the inter-eyebrow distance as the midline of the upper face on these patients can create a wrong foundation from which to start the surgical planning.

General Health

In evaluating a patient for rhinoplasty, one has to take into consideration the general medical conditions that may pose additional risks for the surgery or may cause suboptimal results. The most common medical entity that influences the course of surgery, recovery, and the outcome of rhinoplasty is abnormal coagulation. A whole host of coagulation abnormalities may cause excessive bleeding, especially during rhinoplasty. What makes rhinoplasty more dependent on normal coagulation is the robust arterial circulation due to an abundance of blood vessels within the external and internal nasal structures.

To detect the common coagulation abnormalities, specific inquiry regarding bleeding and easy bruising history is of cardinal value. Reviewing the course of previous surgical procedures and the incidence of excessive bleeding can be extremely informative. The power of observation of the previous operating surgeon, however, plays a salient role in the reliability of this information. What would be normal oozing for one surgeon could be considered excessive bleeding by another more discerning surgeon. Thus, while knowledge of a positive history of excessive bleeding during previous surgery is very helpful, lack of such a history does not exclude the potential for bleeding disorders. History of bleeding after certain surgical procedures such as third molar extraction or tonsillectomy, which are very much dependent on normal coagulation, would be much more informative than after procedures such as appendectomy where there is not much of a raw surface and most vessels are ligated or cauterized during the surgery.

In the past, the most common reason for excessive bleeding was ingestion of pharmaceuticals or food products that had deleterious effects on coagulation. With vigorous patient education, this trend has been altered. Today, at least in our experience, the most common reason for excessive bleeding in the absence of hypertension is an inherited coagulopathy such as von Willebrand disease. Careful inquiry to rule out or establish this condition can avoid intraoperative frustration and poor postoperative outcomes.[1,2]

A history of hypertension in a patient who is to undergo a rhinoplasty is also important since many such patients become hypotensive during surgery and blood pressure rises postoperatively upon awakening from anesthesia, resulting in bleeding from the nose, even though there was no noticeable bleeding during surgery. Control of the blood pressure postoperatively may prevent an emergency visit due to epistaxis and the associated inconveniences for the patient and the surgeon alike because of bleeding.

Diabetes may cause delayed healing for rhinoplasty patients. These patients also have more potential for infection and often heal poorly with excessive scar formation. An external incision may not always heal as favorably in such a patient as in those who do not have diabetes. Judicious use of prophylactic

antibiotics pre- and postoperatively may reduce the potential for postoperative infection.

Immunosuppressed patients are not good candidates for cosmetic rhinoplasty, although septoplasty and turbinate surgery may be considered, like any other medically indicated surgery. A consultation with the immunologist who is caring for the patient is prudent.

Consideration of Patient Concerns

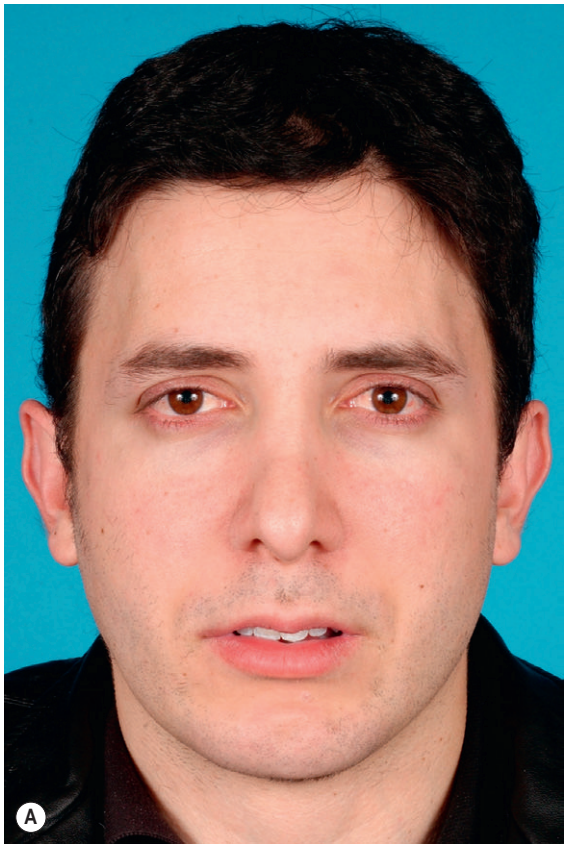
One of the most important requirements for the success of any cosmetic surgery, especially rhinoplasty, is full understanding of the patient's concerns. Disparity between what the patient dislikes and the flaws that the surgeon sees is far more common than is realized. Therefore, it is of paramount importance to ask patients to describe their reasons for the visit and list the specific concerns clearly, preferably on more than one occasion. If the imperfections that the patient observes do not match what the surgeon sees, additional visits are imperative until the sources of the patient's concerns are explicitly understood by the surgeon and the patient's goals precisely match the surgeon's.

History of Nasal Trauma

It is important to ascertain whether any part of the nose deformity is related to a previous nose injury. Specific questions should be asked of the patient to elicit information that otherwise may not be volunteered. These should include whether there was an episode of nose injury, the approximate date, and the nature of the injury. One should ascertain whether the patient was attended by a medical professional, whether any images were obtained, and the nature of the treatment provided at the time of the accident and/or subsequently. The availability of any images acquired at the time of initial injury, or since that time, should be explored. Review of these images may provide additional valuable information.

Airway Symptoms

It is very important to inquire about the breathing difficulties that the patient experiences. This is an intriguing question and answers should be interpreted with prudence. A large number of patients may state that they do not have any breathing problems. However, keen observation may reveal that their lips are apart and that they are complete or partial mouth-breathers (Figure 2.1). These patients have never experienced any other way of breathing and do not realize that they can breathe differently. Additionally, there are patients who



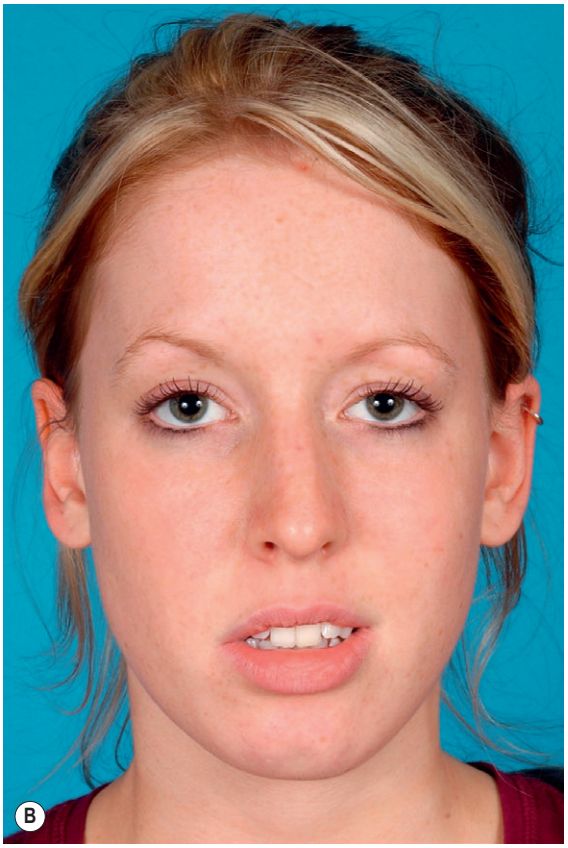


Figure 2.1 All three of these patients are mouth-breathers, but were not aware of breathing difficulties.

consistently breathe only through one side of the nose and examination may demonstrate that one side is completely or significantly obstructed. The patient may be unaware of this condition since most patients do not try to breathe through each nostril independently. These two situations should not be missed because they can have serious consequences. However, a clear majority of patients with breathing difficulties, although they may not volunteer the information, will provide enough information when asked specific questions to enable the surgeon to reach a proper conclusion related to any breathing abnormalities.

Requiring the patient to complete a comprehensive questionnaire similar to the one included in this chapter (the functional nose form – Table 2.1) will provide an opportunity for thorough documentation of the nose dysfunction. There are some additional questions that will lead to a better diagnosis of the condition causing the nasal obstruction. These include the frequency of airway problems, consistency, laterality, and whether there are any allergy-related symptoms such as rhinorrhea, sneezing, watery eyes, itching, and loss of sense of smell and taste. Nose-related allergies are very common and nasal airway obstruction may be the only symptom, since sometimes allergies are purely nasal and may not be very obvious. Additionally, other conditions such as vasomotor rhinitis are reasonably common and can cause breathing difficulty or compound a mechanical or valvular nose obstruction. Since the majority of successful rhinoplasties are reductive in nature, if there is an undetected and uncorrected underlying airway compromise, rhinoplasty on these patients may cause deterioration of the breathing problems and convert an aesthetic concern to a functional predicament.

Sinus Infections, Sinus and Migraine Headaches

Abnormal flow of air due to any anomaly in the turbinate or septal structures can result in mild, moderate, or severe headaches. Correction of these structural abnormalities frequently results in functional improvement and elimination of headaches. In this scenario, if the patients are also pleased with the aesthetic outcome, the surgery will be regarded as very successful. Conversely, a patient who experiences mild periodic sinus headaches may notice more frequent and more serious sinus headaches and infections if the existing abnormalities are not corrected during a reductive rhinoplasty. If the presence of any sinus infections and headaches is not recorded preoperatively, the patient may attribute these conditions to the rhinoplasty, not recalling that the headaches existed prior to surgery.

Table 2.1 Functional Nose Information Sheet

	Yes	No
Do you have any difficulty breathing through your nose?	☐	☐
Do you experience sinus headaches?	☐	☐
Are you a mouth breather?	☐	☐
Do you experience sore throats and dry chapped lips in the morning as a result of mouth breathing?	☐	☐
Do you snore?	☐	☐
Do you find that it is harder to breathe through your nose when lying down?	☐	☐
Do you find it necessary to prop your head up on more than one pillow?	☐	☐
Do you use any of the following?	☐	☐
Nasal irrigations or sprays?	☐	☐
Vaporizer?	☐	☐
Humidifier?	☐	☐
Do you take over-the-counter nose sprays and decongestants?	☐	☐
If yes, please list them:		
Do you wake up at night due to difficulty breathing through your nose?	☐	☐
Do your breathing problems limit your participation in activities such as running, sports, or other forms of exercise?	☐	☐
If yes, does this interfere with your daily function or job performance?	☐	☐
Have you seen a medical doctor for treatment of the breathing problem through your nose?	☐	☐
Doctor's name_____		
Address_____		
Treatment dates _____		
What treatment was advised?_____		
_____		
Did you benefit from the treatment?	☐	☐

Over 60% of patients who have migraine headaches have a rhinogenic trigger site.[3] Migraine headaches afflict approximately 12% of the population (18% of females). If the presence of this type of headache is uncovered and the condition is eliminated, it may provide an extremely successful aesthetic and functional outcome for the patient. Learning about the nature of the patient's headaches, where they start from and how long they last, is very important. Rhinogenic migraine headaches usually start from an area behind the eyes, the patient often wakes up with a headache in the middle of the night or early morning, and the headaches are commonly triggered by changes in the atmospheric pressure. Frequently, the patient develops rhinorrhea at the time they are suffering from these headaches. Many such patients complain of chronic daily headaches that may not respond to triptans and are not responsive to injection of botulinum toxin A. Discovery of this constellation of symptoms will help to diagnose and effectively serve patients who are suffering from rhinogenic migraine headaches.[3–7]

Observations of the Face

The Skin Quality

One should assess the entire face prior to focusing on the nose. Consequently, observation of the quality of the skin will be the first area of assessment. Patients who have either thick or thin skin present a challenge for the rhinoplasty surgeon. This should be noted and discussed with the patient. Patients with thick, oily skin often present difficulty in achieving proper definition. On the other hand, thin skin introduces difficulty in hiding minor imperfections, and the outline of grafts may also appear too harsh.

Assessment of Facial Structures Other Than the Nose

For a successful rhinoplasty outcome, there should be a perfect harmony between the nose and the surrounding structures. Therefore, the first step in achieving a proper congruity between the nose and the rest of the face is familiarity with the entire face. The analysis of the face should take place in an organized manner by dividing it into three segments – upper, mid, and lower zones – and reviewing each zone on front and profile views (Figure 2.2). Initially, each zone is assessed separately. The degree of harmony between the three zones is then evaluated.

When assessing the front view of the forehead, one should observe the length and width of the forehead and the position and arch of the eyebrows. In the mid-face zone, one pays attention to the eyes first. Intercanthal and interpupillary distances are assessed first during mid-face analysis. The normal intercanthal distance is approximately 31–33 mm. As we will discuss in later chapters, this distance becomes crucial in managing the nasal bones, the

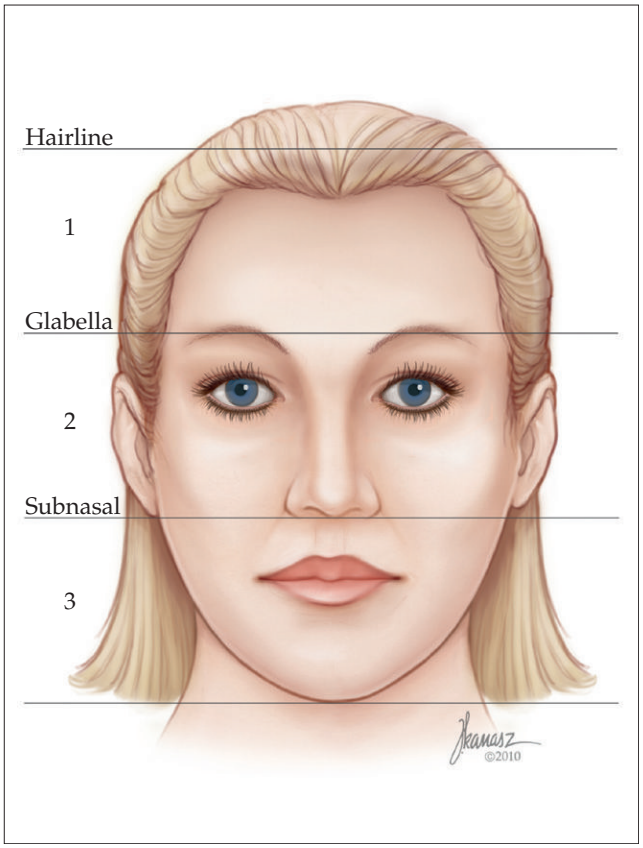


Figure 2.2 Division of the face into three zones for an organized review.

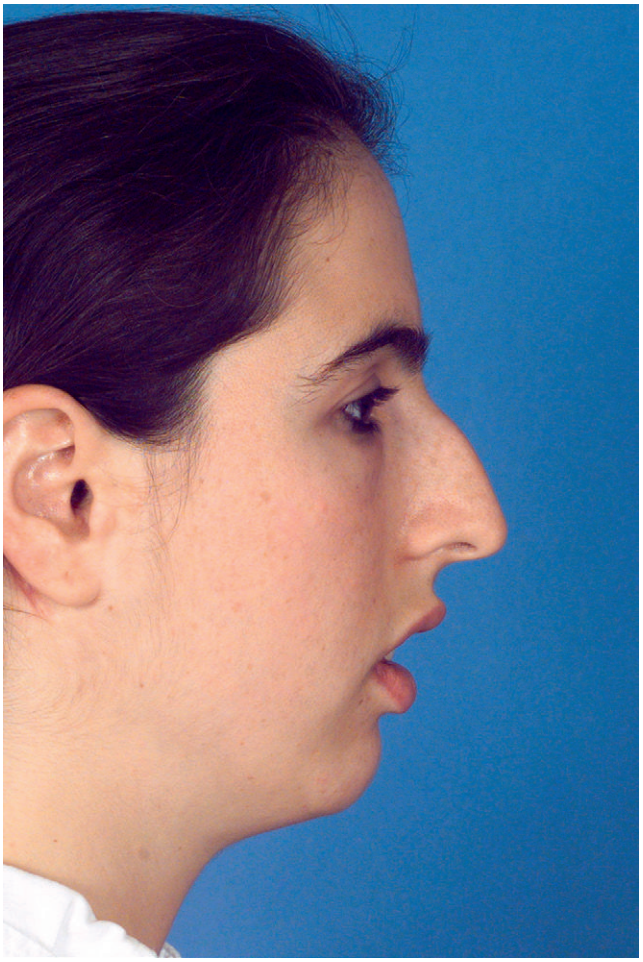


Figure 2.3 An overprojected nose causing a tense upper lip.

dorsal projection, and the radix. In order to create a proper balance in the midface, there must be an optimal relationship between the malar and nasal bones. Therefore, flatter malar bones may benefit from augmentation in order to achieve the best harmony in the zone. Perinasal hypoplasia may require augmentation of the other structures surrounding the nose.

An over-projected caudal nose may result in a short and tense upper lip (Figure 2.3). Reduction of the nose projection will reduce this tension and elongate the lip. In an ideal face, the length of the nose matches the distance from the stomion to below the chin. Therefore, having a normal lower face length is essential for restoration of facial harmony. Vertical alignment of the chin, lip and nose is examined carefully.

The profile view of the forehead and its projection plays a significant role in planning the rhinoplasty. In order to judge the depth of the radix, one has to first ascertain whether the glabellar projection is optimal. Frontal bossing or flatness of the glabella may be misleading when judging the radix depth.

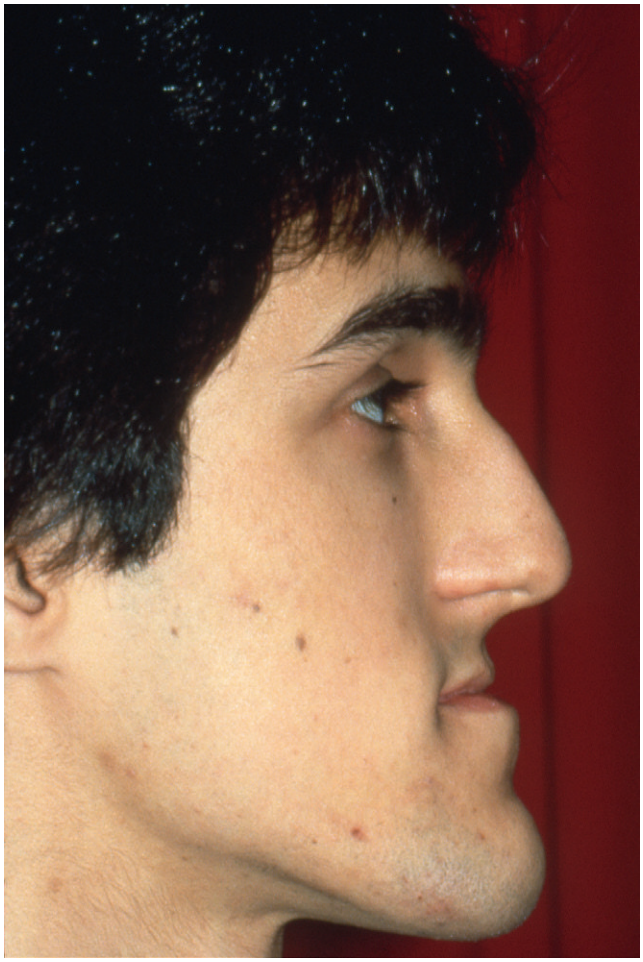


Figure 2.4 A patient with maxillary deficiency, mandibular excess, and nasal imperfections.

Figure 2.5 A patient with an underprojected chin and a prominent nose.

The prominence of the malar bones can be better assessed on the profile view.

On this view, one also assesses the length of the upper lip and its proportion in relation to the rest of the face. The projection of the chin becomes important in judging the projection of the nose (Figure 2.4). The nose and chin may have a paradoxical relationship whereby a patient may have an overprojected nose and at the same time an underprojected chin (Figure 2.5). This nose will not look optimal without correction of the chin deficiency. The reverse could be true: the nose could be underprojected while the chin is overprojected. Here, one has to reduce the chin and augment the nose at the same time to achieve a better balance to the face. Of even greater importance is an overprojected nose and a prominent chin occurring simultaneously. In this case,

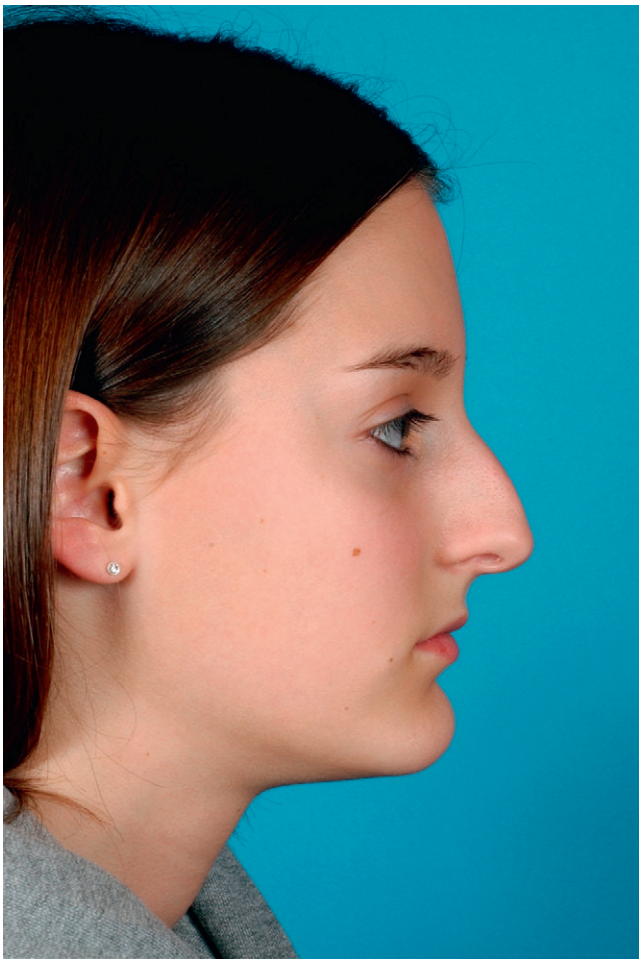


Figure 2.6 A patient with prominent nose and a prominent chin.

reduction of one structure may exaggerate the other disharmony (Figure 2.6). In such a case the correction of both abnormalities is imperative. Correction of coexisting orthognathic abnormalities will enormously enhance the overall rhinoplasty outcome.

No facial evaluation is complete without examination of the oral cavity. It is very important to assess occlusal abnormalities as well as the palatal configuration and propose their correction prior to rhinoplasty.

Additionally, observation of both the front and profile views while the patient smiles is very important. By asking the patient to smile, one can observe a host of abnormalities, including the horizontal line that may appear in the upper lip, the magnitude of insufficient or excessive incisor show, and facial asymmetries. The importance of the smile view is discussed further in the section on the review of the nose itself.

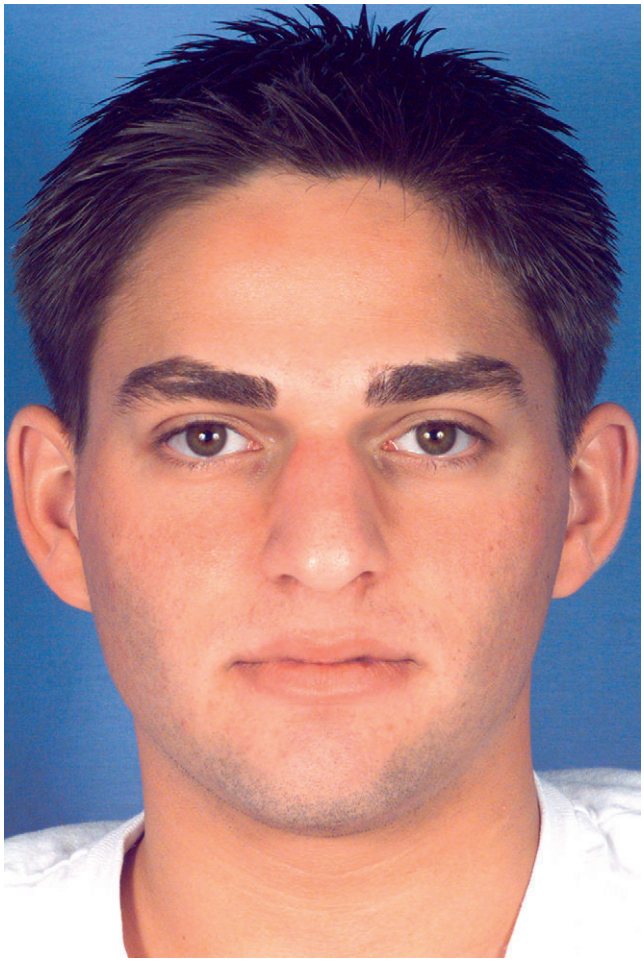


Figure 2.7 Wide and long nasal bones harbor more potential for medialization of the ULC following osteotomy.

Figure 2.8 Asymmetric nasal bones require special treatment.

Examination of the Nose

It is very helpful to develop an organized way of examining the nose on the front and profile views. Starting from the nasal bones, on the front view, one may note the symmetry and width of the nasal bones. This is crucial for the intraoperative management of the nasal bones. It is also beneficial to assess whether they are long or short, which makes a difference when repositioning the nasal bones and the upper lateral cartilage (ULC) during the osteotomy and to their postoperative stability. Longer nasal bones are more stable but also have more potential for medialization of the ULC following osteotomy and repositioning of the bones (Figure 2.7). Observation of nasal bone asymmetry will lead to differential treatment of the nasal bones (Figure 2.8). The width and symmetry of the ULC are assessed next (Figure 2.9).

Figure 2.9 Example of a wide and asymmetric ULC.

A variety of abnormalities can be discovered during a circumspect observation of the lower lateral cartilages (LLC) (Figure 2.10). In assessing the LLC, one has to note flaws such as cephalic malposition, excessive or inadequate distance between the domes, asymmetry of the light reflection points, and thus the domes. The LLC can be configured in such a way as to cause a boxy or a round tip. The position of the lobule and the relationship of the nostrils to the columella are very important.

The width, position, and symmetry of the alar bases are evaluated next. The vertical and horizontal position of the alar base is also assessed on front view, in repose and while smiling. Ideally, the interalar base distance is about 2 mm wider than the intercanthal distance. If the intercanthal distance is abnormal, one can use the orbital fissure width, which equals the ideal intercanthal distance (31–33 mm), as a reference.[8]

On the profile view, the first zone to assess is the radix, which should be 6 mm deep for a female and 4 mm deep for a male (Figure 2.11). The deepest

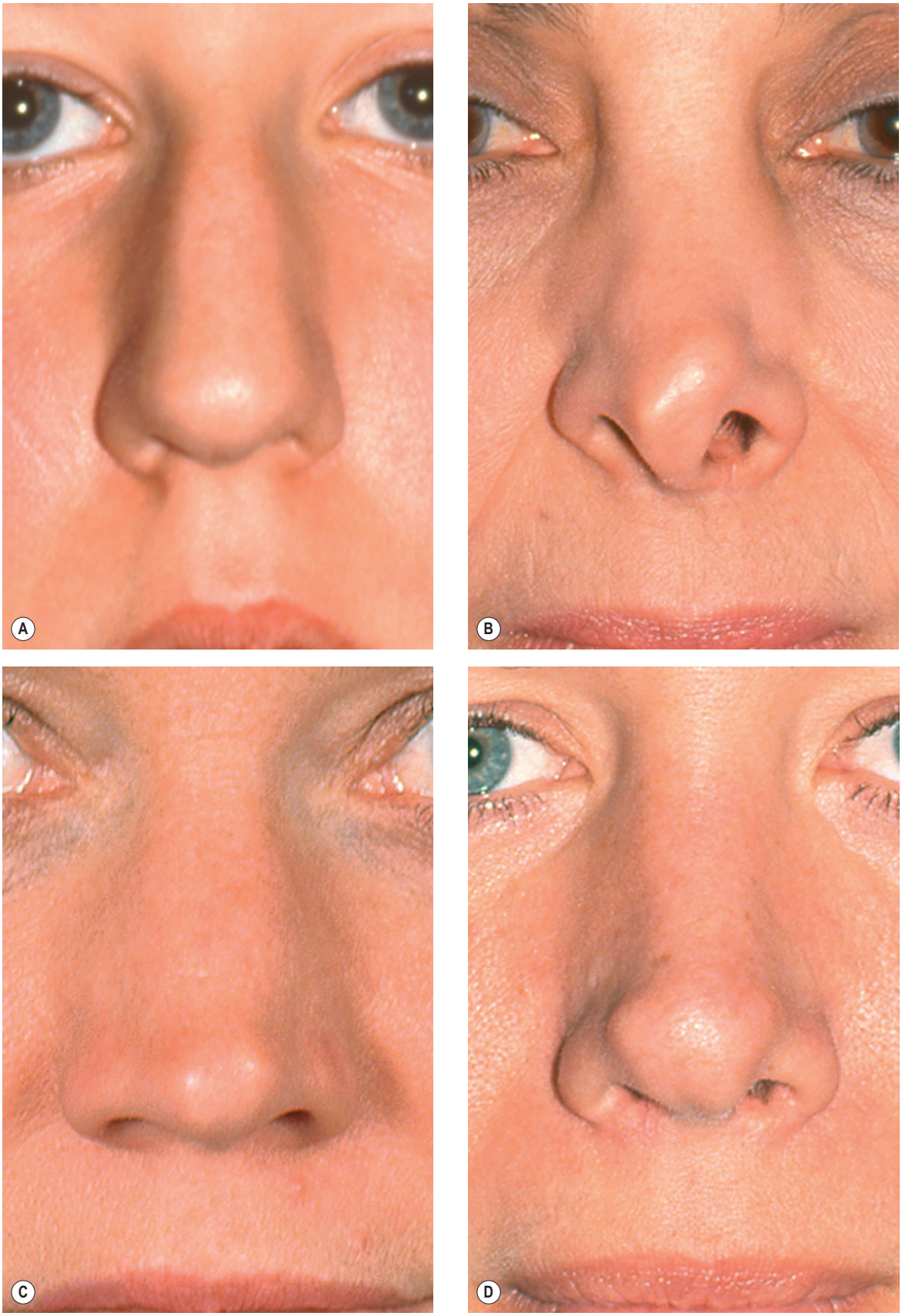


Figure 2.10 Different dysmorphologies of the LLC.

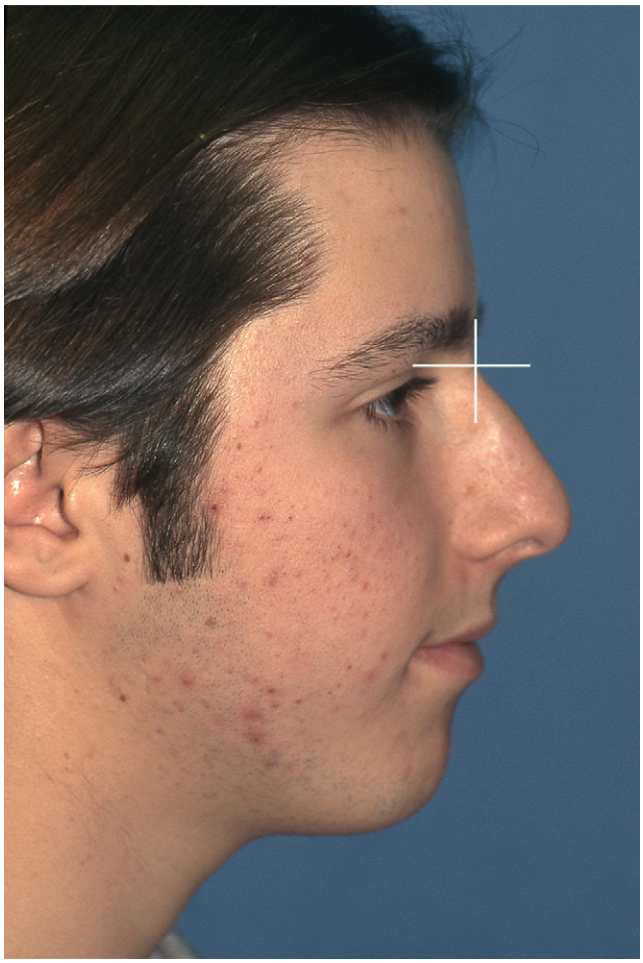


Figure 2.11 The ideal radix is 4 mm deep in a male and 6 mm in a female.

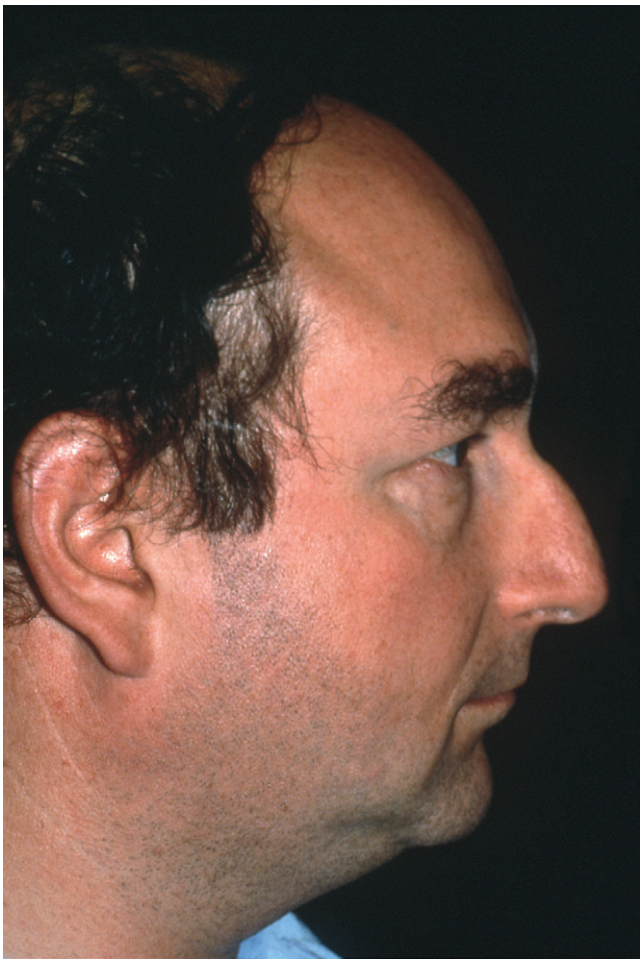


Figure 2.12 This patient has a large hump with a combination of bone and cartilage excess.

portion of the radix is at the level of the supratarsal crease. The dorsal hump is assessed regarding its size, location, and whether it is largely bony or cartilaginous. Any dorsal deficiency is identified (Figure 2.12). The nasal length is then assessed, which equals the distance from the stomion to the submentale. There should be a well-defined supratip break on females. The alar base should be vertically located at a point approximately 2 mm above the junction of the upper two-thirds, with the lower one-third of the line connecting the medial canthus to the stomion (Figure 2.13).[9] Although the nasolabial and the columellolabial angles have been defined as 90–115°, our observations and studies have determined that the range is only around 94–97° for a male and 97–100° for a female. The columella should protrude about 3–4 mm caudal to the alar rim, as long as the alar rim is deemed to be in an optimal position. At this point, the patient is asked to smile while the profile view is observed. Movement of the tip is noted to gauge the activity of the depressor nasi septi muscle and to note how the angle between the lip and the nose changes with smiling.

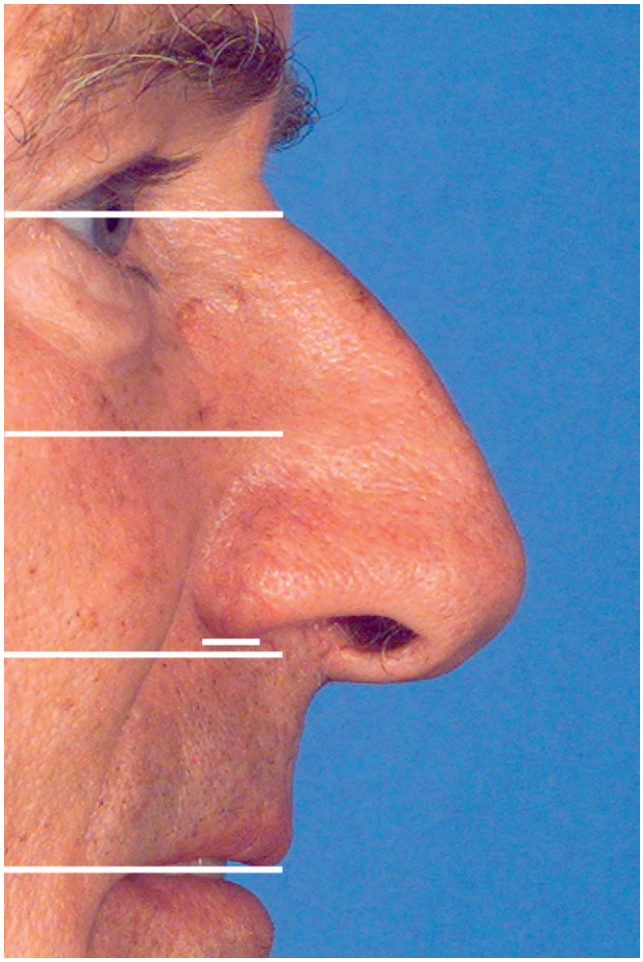


Figure 2.13 The base of the ala is located 2 mm cephalad to the junction of the upper two-thirds and lower one-third of the distance from the medial canthus to the stomion.

Figure 2.14 The basilar view demonstrates a multitude of flaws in the tip, ala, nostrils, and columella.

The patient is then asked to tilt the head back and the basilar view is observed. In this view, the symmetry of the domes, width and direction of the columella, nostril length and orientation, and nostril width are noted (Figure 2.14). One of the most helpful views to assess the direction of the nose is an overhead view. The patient is asked to tilt the head back and the direction of the nose is assessed in relation to the rest of the face. Any minor imperfection can be easily detected in this view.

A careful examination of the internal nose is crucial. The septum is observed for deviation. The type of septal deviation is recorded (see the classification of deviated septum in Chapter 17). The presence of any spur, synechia, and perforation is noted. If present, the size of the perforation is measured and its location is identified and documented. Any type of stenosis is also recorded.

The turbinates are then observed for color, size, and whether they are in contact with the septum, initially without and then with vasoconstriction.

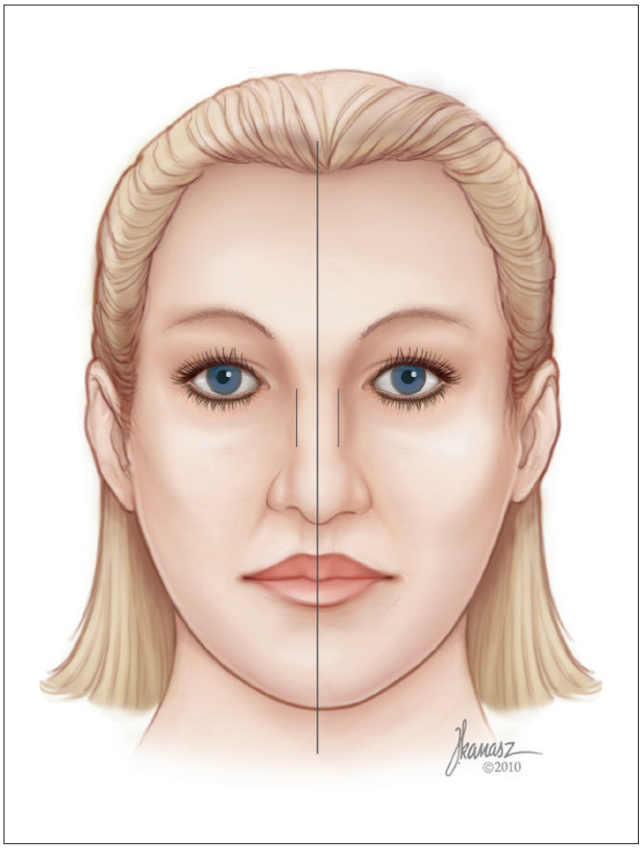


Figure 2.15 The midpoint between the medial canthi is connected to the midpoint of the upper lip (philtrum dimple). Two smaller vertical lines are then drawn 7 mm from this center line.

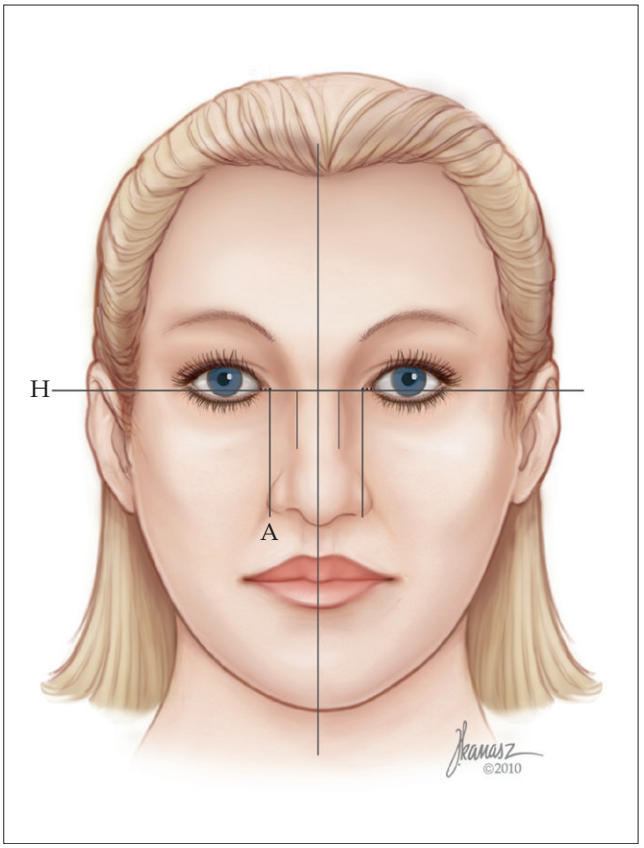


Figure 2.16 The medial canthi are connected with a horizontal line (H) continued laterally. A vertical line is dropped from each medial canthus to pass vertically through the alar bases (A).

The presence of any polyp is also documented. In patients who have rhinogenic migraine or sinus headaches, or frequent sinus infections, a computed tomography (CT) scan of the nose and paranasal sinuses is obtained and reviewed.

A set of life-size photographs of the front and profile views is procured digitally and analyzed using the step-by-step analysis described below. A drafting film is placed over the photograph and fixed in position with tape.

Frontal View

1. The midpoint between the medial canthi is connected to the midpoint of the upper lip (philtrum dimple; Figure 2.15). Two smaller vertical lines are then drawn 7 mm from this center line.
2. The medial canthi are connected with a horizontal line (H) continued laterally (Figure 2.16). A vertical line is dropped from the medial canthus bilaterally (A).

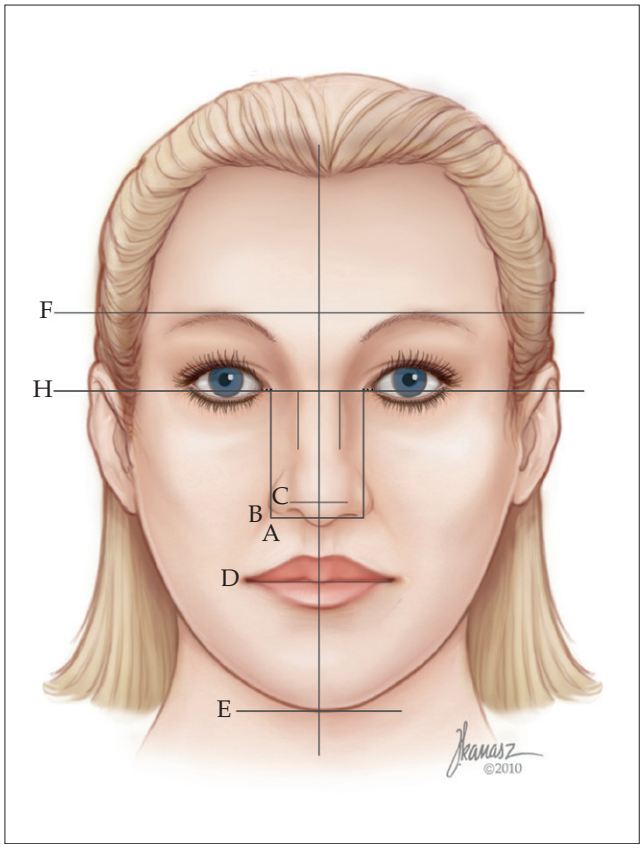


Figure 2.17 A horizontal line is drawn touching the lower border of the alar base (B). A second line is then placed 5 millimeters above this line (C). A third horizontal line connects the oral commissures (D), and a fourth line is placed along the lower border of the chin (E). A horizontal line is then drawn passing through the caudal border of the eyebrows (F).

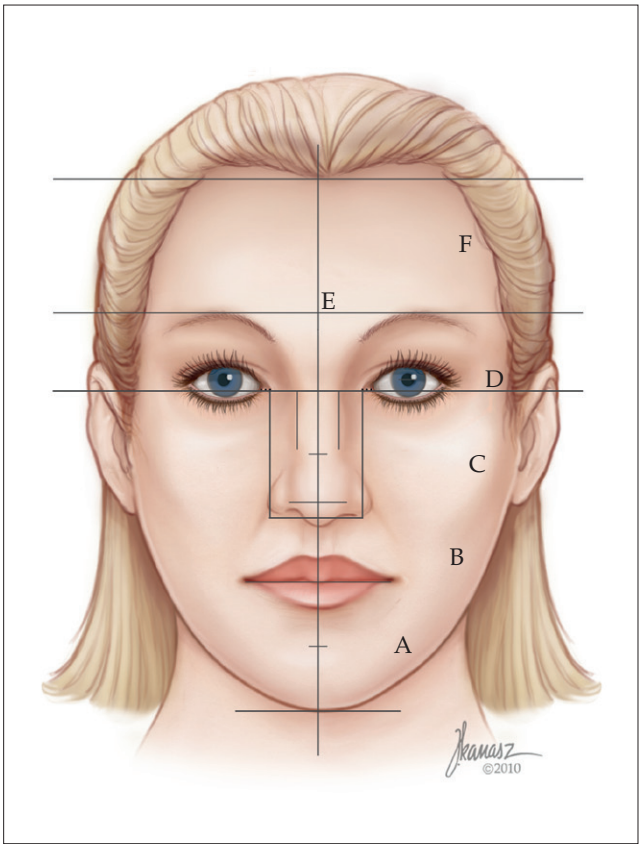


Figure 2.18 The distance between these lines is then measured to show the proportions of the face. The measurements include the chin line to the stomion (zone A), the stomion to the alar base (zone B), the alar base to the medial canthi (zone C), the intercanthal line to the eyebrow line (zone D), and finally the distance between the medial canthi (zone E). Ideally, D×2=C=B×2=A=E.

3. A horizontal line is drawn touching the lower border of the alar base (B). A second line is then placed 5 mm above this line (C). A third horizontal line connects the oral commissures (D), and a final line is placed along the lower border of the chin (E). This divides the face from the eyes to the chin into five equal spaces; two portions from the medial canthi to the alar base, another portion from the alar base to the stomion, and two spaces for the lower face, from the stomion to the chin. A horizontal line is then drawn passing through the caudal border of the eyebrows (F) (Figure 2.17).
4. The distance between these lines is then measured to show the proportions of the face (Figure 2.18). The measurements include the chin line to the stomion (zone A), the stomion to the alar base (zone B), the alar base to the medial canthi (zone C), the intercanthal line to the

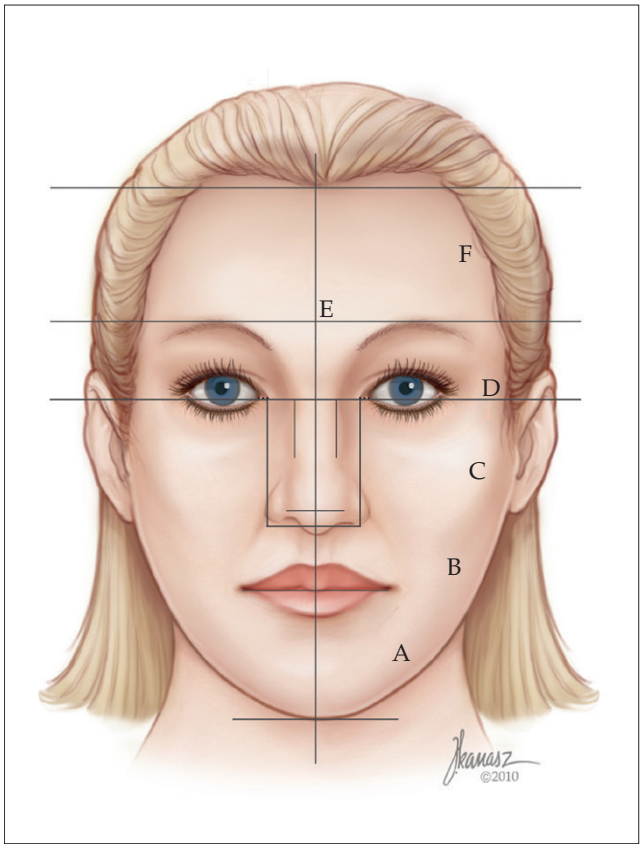


Figure 2.19 Usually, the alar base outline is 1–2 mm outside of the vertical lines dropped from the medial canthi. In general, the intermedial canthus distance is equal to the distance from the medial canthus to the lateral canthus. However, if the intercanthal distance is narrower or wider than the palpebral fissure width, then the latter will be used to judge the width of the alar base. On this illustration, the alar bases have been designed asymmetrically.

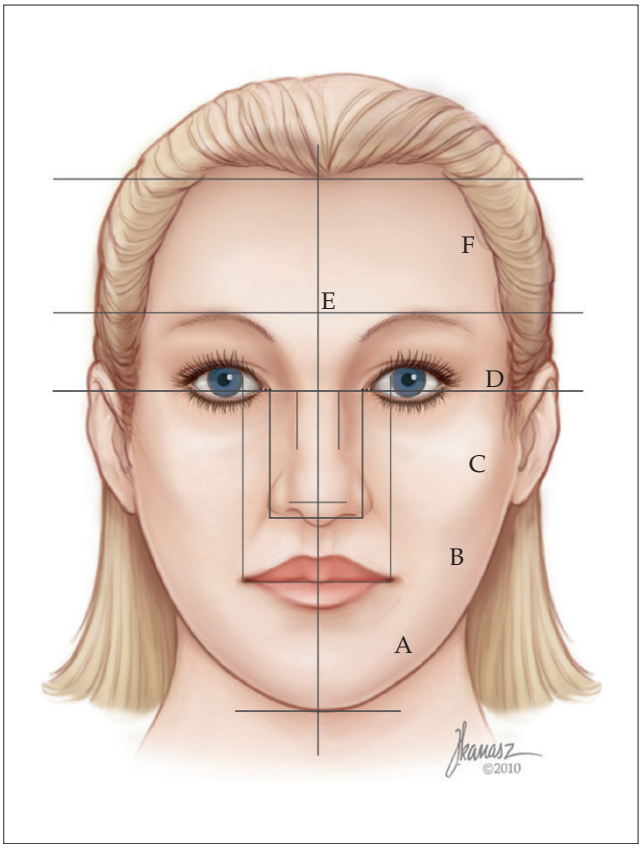


Figure 2.20 A vertical line is dropped from the most medial portion of the limbus, which usually passes through the oral commissures outlining the commissure width.

eyebrow line (zone D), and finally the distance between the medial canthi (zone E). Ideally, D×2=C=B×2=A=E.

5. A vertical line is dropped from each medial canthus to pass vertically through the alar bases (Figure 2.19). Usually, the alar base outline is 1–2 mm outside this line. In general, the intermedial canthus distance is equal to the distance from the medial canthus to the lateral canthus. However, if the intercanthal distance is narrower or wider than the palpebral fissure width, then the latter will be used to judge the width of the alar base. In this illustration, the alar bases have been designed asymmetrically.
6. A vertical line is dropped from the most medial portion of the limbus. This usually passes through the oral commissures, outlining the commissure width (Figure 2.20).

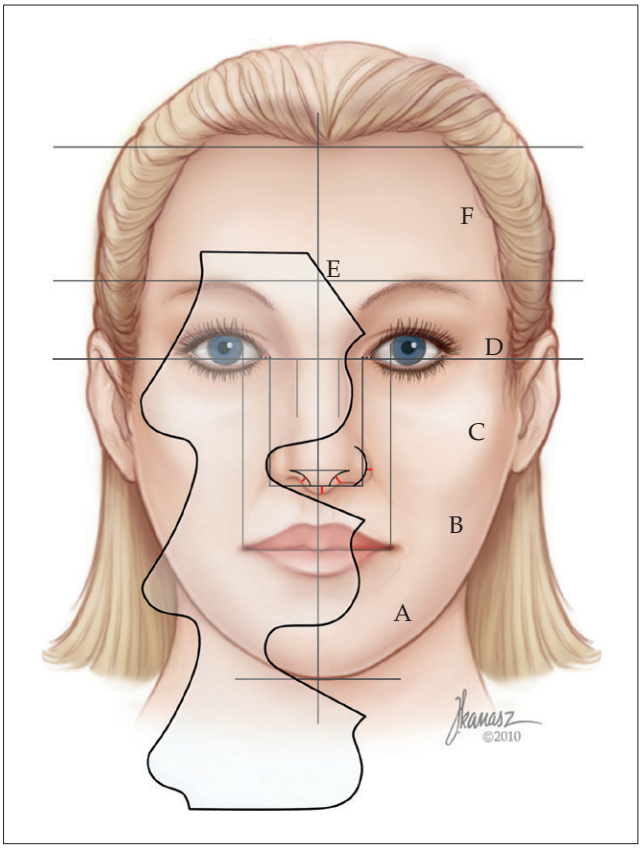


Figure 2.21 The segment of the template between the two chin outlines is used to draw the outline of the optimal alar base.

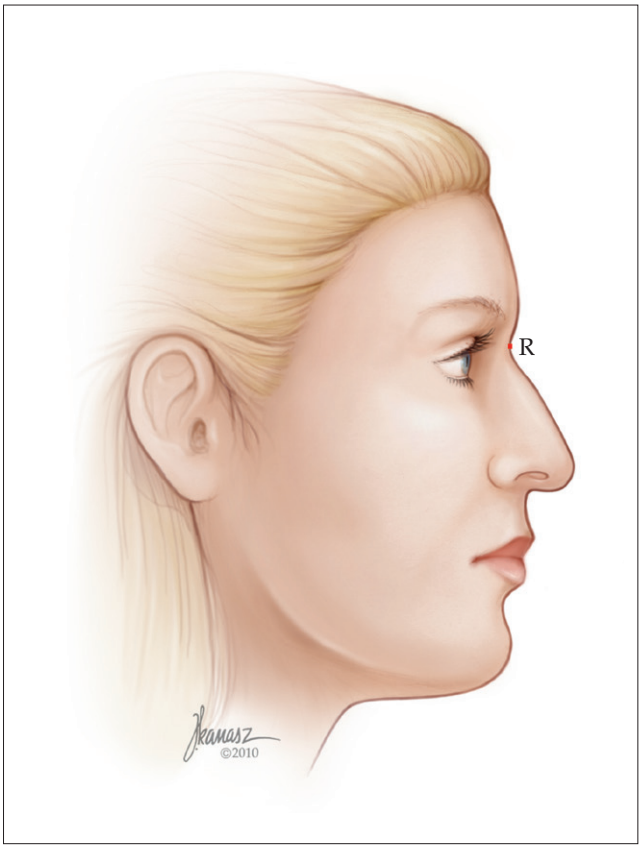


Figure 2.22 The first step in analysis of the profile is to define the nasofrontal groove. If this groove is too shallow or too deep, the radix is considered to be 4–6 mm deep in the horizontal plane and at the level of the upper tarsal crease in a straight gaze.

7. The segment of the template between the two chin outlines is used to draw the outline of the optimum alar base (Figure 2.21).

The front-view analysis will reveal any nasal bridge or tip deviation and, more importantly, alar base disproportion.

Profile View

A drafting film is now placed over the profile life-size photograph.

1. The first step in analysis of the profile is to define the nasofrontal groove (Figure 2.22). If this groove is too shallow or too deep, the the radix is defined 4–6 mm deep in the horizontal plane and at the level of the upper tarsal crease in a straight gaze.

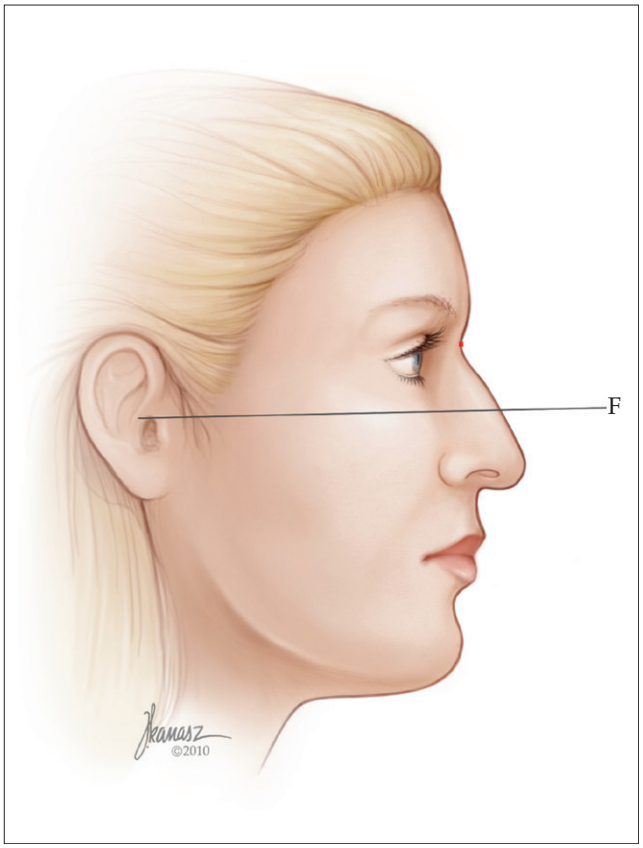


Figure 2.23 The upper border of the tragus is connected to the infraorbital rim, as marked on the patient before photography. This line is continued past the nasal outline (Frankfort horizontal plane; line F).

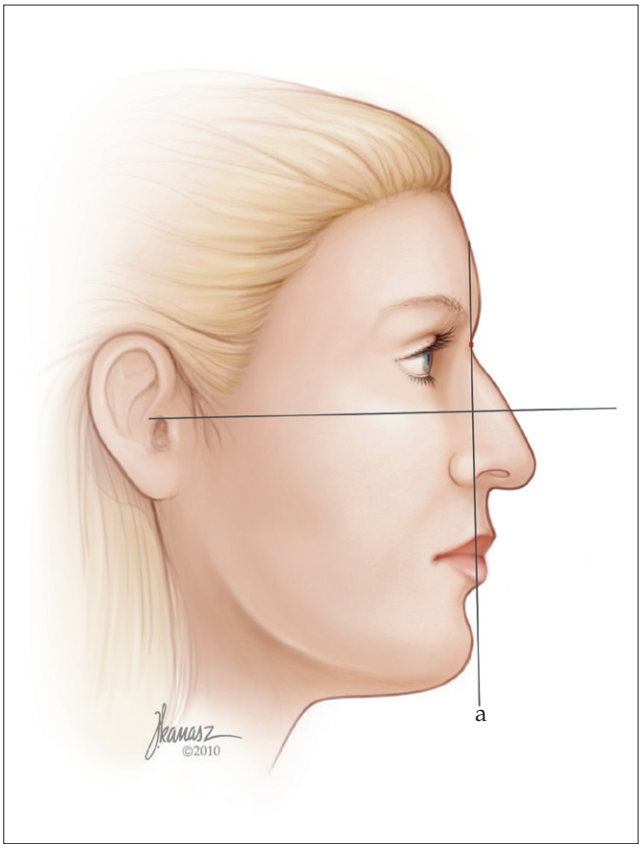


Figure 2.24 A line is dropped from the radix in a 90° relation to the Frankfort horizontal line. This will define the vertical facial plane (line a).

2. The upper border of the tragus is connected to the infraorbital rim as marked on the patient before photography (Figure 2.23). This line is continued past the nasal outline (Frankfort horizontal plane; line F).
3. A line is dropped from the radix in a 90 degree relation to the Frankfort horizontal line (Figure 2.24). This will define the vertical facial plane (line a).
4. From the radix, the dorsum is drawn at a 34 degree angle for a female and a 36 degree angle for a male in relation to the vertical facial plane (Figure 2.25; line b).
5. The distance between the radix or medial canthus and the stomion (upper and lower lip junction; point S) is measured and divided into three equal segments (Figure 2.26).
6. A horizontal line is drawn parallel to the Frankfort horizontal facial plane 2–3 mm below the junction of the lower third with the upper

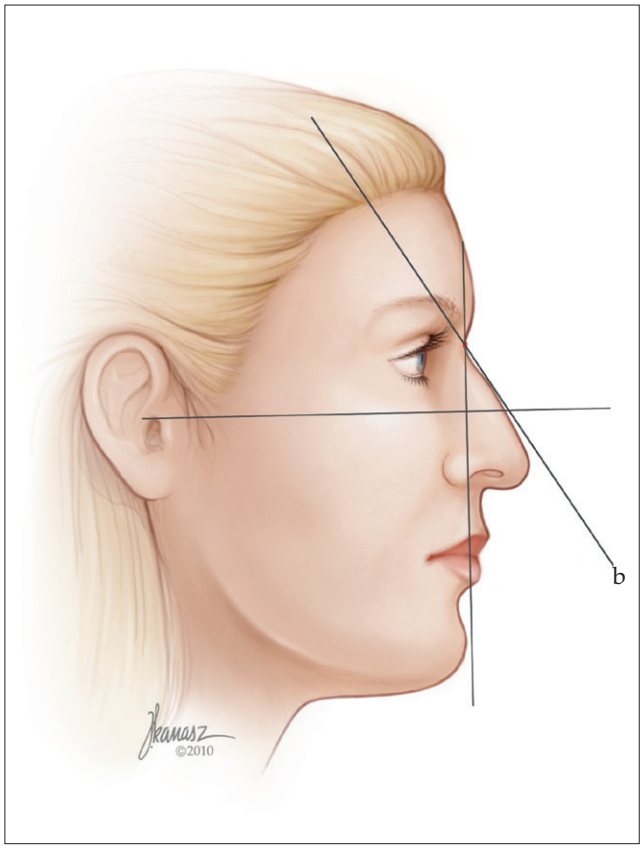


Figure 2.25 From the radix, the dorsum is drawn in relation to the vertical facial plane at a 34° angle for a female and a 36° angle for a male (line b).

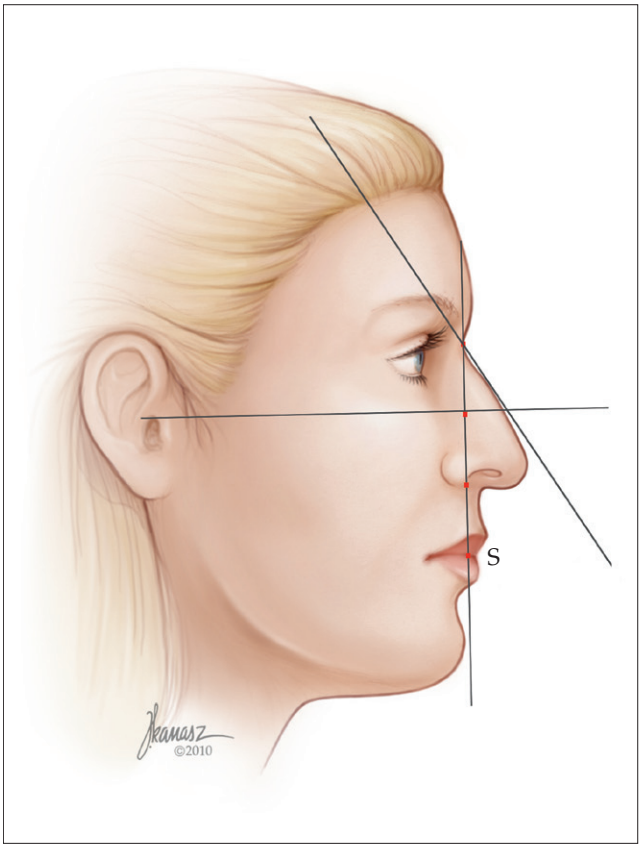


Figure 2.26 The distance between the radix or medial canthus and the stomion (upper and lower lip junction; point S) is measured and divided into three equal segments.

two-thirds (Figure 2.27; line c). This will outline the horizontal guide for locating the subnasale.

7. The most projected portion of the upper lip (labrale superius) is marked (Figure 2.28). A vertical line is drawn 1–2 mm behind this point parallel to the vertical facial plane (line d).
8. The subnasale is located at the point of intersection of this line with the horizontal line described in 6 (Figure 2.29). A line is projected from the subnasale at a 97–100° angle for a female and a 94–97° angle for a male in relation to the vertical line in order to construct the nasolabial angle (line e). We now have a triangular nasal frame within which the nasal profile can be drawn with pleasing proportions.
9. The prefabricated nose template is used to create the nasal outline in a segmental fashion using different portions of the template (Figure 2.30).

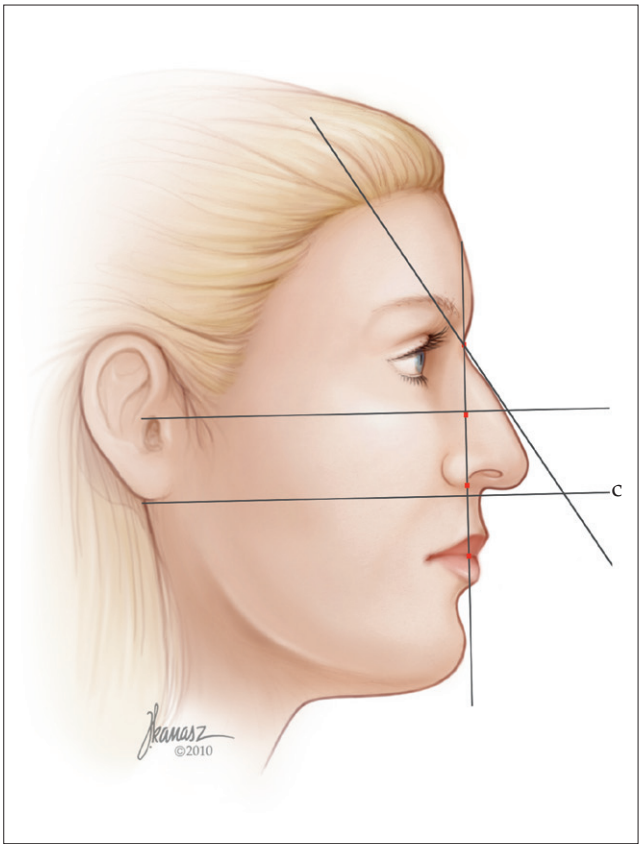


Figure 2.27 A horizontal line is drawn parallel to the Frankfort horizontal facial plane 2–3 mm below the junction of the lower third with the upper two-thirds (line c). This will outline the horizontal guide for locating the subnasale.

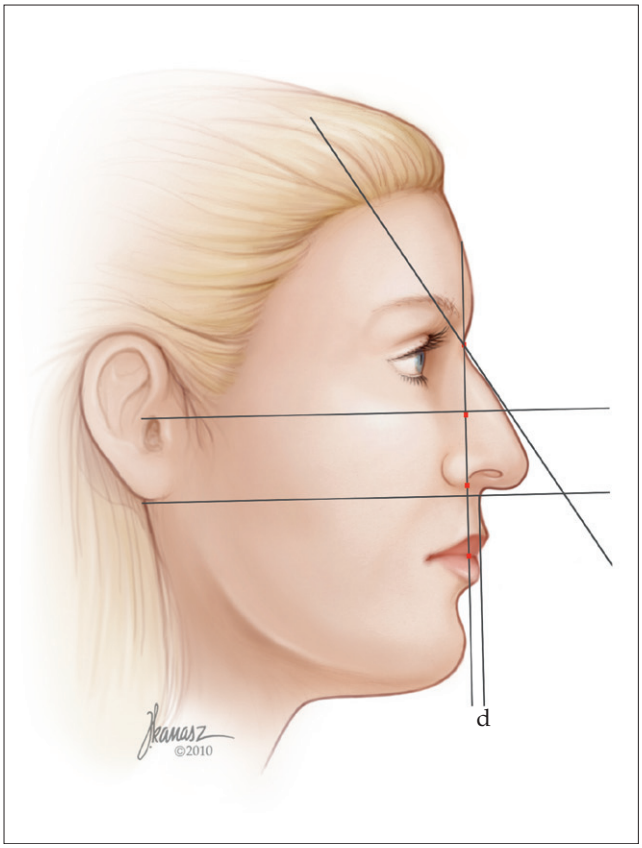


Figure 2.28 The most projected portion of the upper lip (labrale superius) is marked. A vertical line is drawn 1–2 mm behind this point parallel to the vertical facial plane (line d).

10. The most prominent portion of the upper lip is connected to the most prominent portion of the lower lip and continued (Figure 2.31). This line (Riedel's line) usually touches the most prominent portion of the chin (pogonion). If the chin recedes, the chin template is used to draw a proper labiomental groove and chin prominence. The labiomental groove is usually 3–4 mm deep in a female and 4–5 mm deep in a male.

Planning Rhinoplasty

Rhinoplasty is a procedure in which 0.25 mm makes a difference to the outcome. In fact, there is no procedure in plastic surgery that requires as much precision. Therefore, it is not only crucial to analyze the nose clinically, it is of paramount importance to analyze the life-size pictures using one of the techniques described. Analysis of these photographs will also facilitate

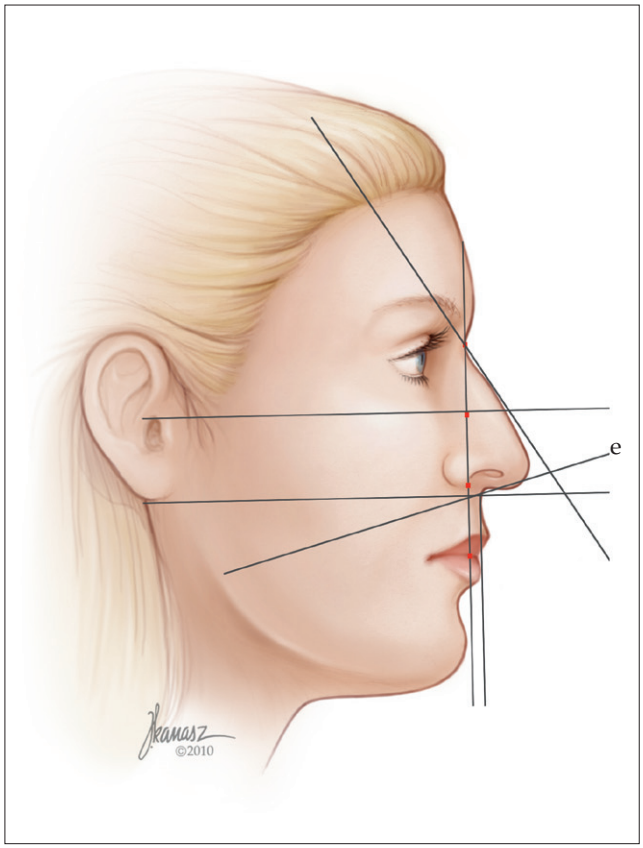


Figure 2.29 The subnasale is located at the point of intersection of this line with the previous horizontal line shown in Figure 2.27. A line is projected from the subnasale at a 98–108° angle for a female and a 95–98° angle for a male in relation to the vertical line in order to construct the nasolabial angle (line e). We now have a triangular nasal frame within which the nasal profile can be drawn with pleasing proportions.

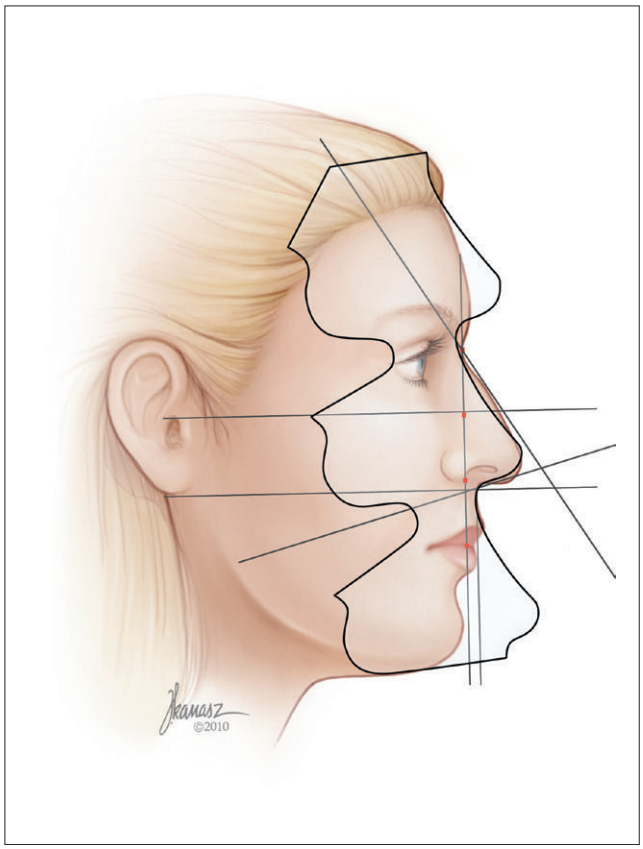


Figure 2.30 The prefabricated nose template is used to create the nasal outline.

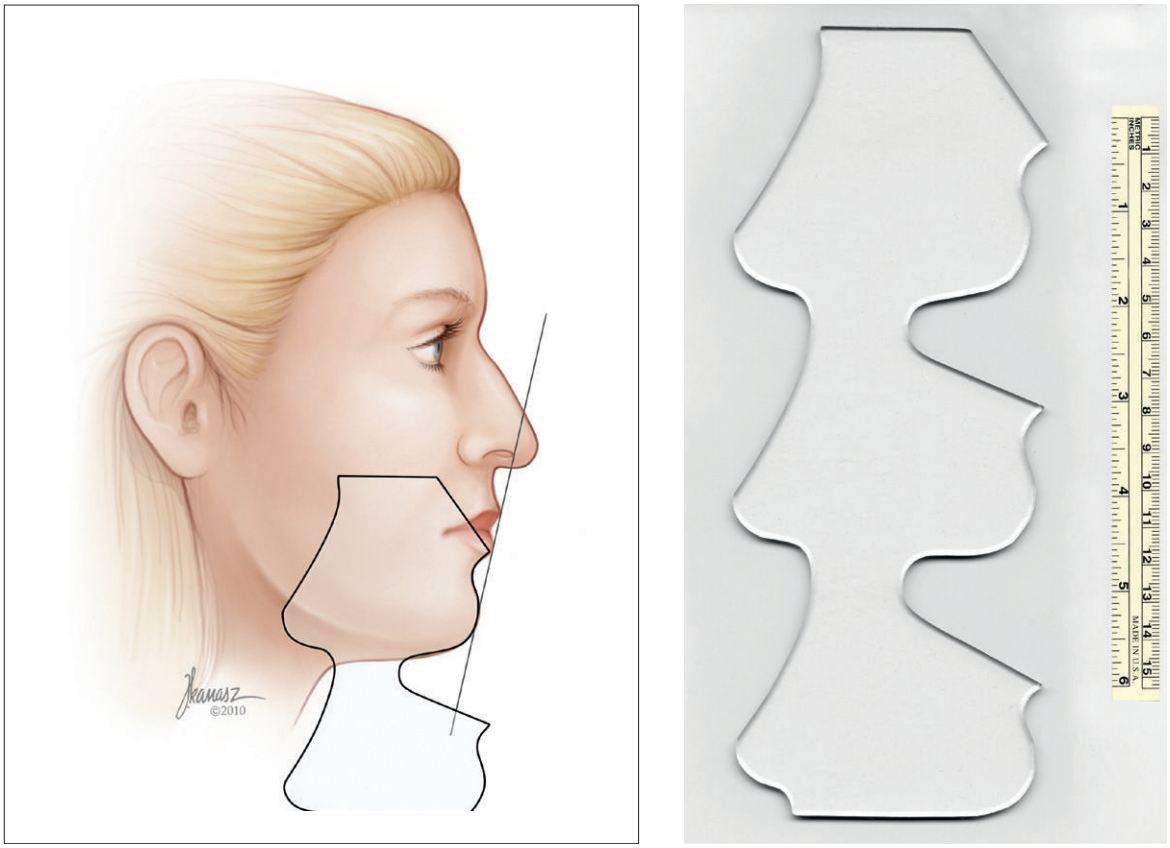


Figure 2.31 The most prominent portion of the upper lip is connected to the most prominent portion of the lower lip and continued. This line (Riedel's line) usually touches the most prominent portion of the chin (pogonion). If the chin recedes, the chin template is used to draw a proper labiomental groove and chin prominence. The labiomental groove is usually 3–4 mm deep in a female and 4–5 mm deep in a male.

detection of other facial flaws that might otherwise be missed. This type of analysis also helps to design a precise blueprint of the surgical goals and requires time to be spent becoming more familiar with the patient's face and nose.

Patient Selection and Potential Traps

Rhinoplasty is destined for failure and disappointment if one does not carefully select the appropriate patient and choose the right operative maneuvers. There are some circumstances that can increase the failure rate and contribute to disappointing and sometimes disastrous results if one is not aware of or does not deal with them. These rhinoplasty traps can be characterized by psychological, functional, or form/anatomy elements.

Psychological Elements

Psychological elements are perhaps the most perplexing factors causing rhinoplasty failure, and may result in disappointment notwithstanding the physical success of the rhinoplasty. Recognizing a patient who may not be pleased with the outcome of surgery or who has unrealistic expectations is extremely difficult and is an acquired skill slowly attained with experience. The dearth of information on patients who do not have a suitable psychological and emotional frame for undergoing surgery has been an issue for many plastic surgeons in the past. However, today there is a good deal of knowledge shared in the literature and during national and international presentations that should reduce the number of severely dissatisfying rhinoplasty outcomes resulting from psychological disorders. Detection of certain criteria and signs individually or collectively can provide sufficient information for the surgeon to suspect an underlying psychological condition that will lead to patient dissatisfaction regardless of surgical outcome. These clues may guide the surgeon to further explore the rationale for the surgery and begin a more in-depth psychological consideration, perhaps through a visit with a specialist. Whether with rhinoplasty or other aesthetic procedures, the symptoms listed in Box 2.1 should provide the examiner with sufficient warning.

BOX 2.1

Symptoms of an Underlying Psychological Problem Likely to Result in Patient Dissatisfaction

- Minimal disfigurement with maximal concern
- Confused or vague motives for wanting surgery
- Unrealistic expectations of change in life situation as a result of surgery
- Unresolved grief or being currently in a crisis situation
- Present misfortunes blamed on physical appearance
- Sudden dislike for the nose, especially in an older man
- A hostile, blaming attitude towards authority figures
- History of seeing physicians and being dissatisfied with them
- Patient's behavior or attitude makes the physician feel uncomfortable
- Obvious clinical signs of emotional instability
- Patient's objectives are in conflict with your aesthetic judgment
- Patient provides you with deceitful information
- Patient demands guarantees
- Patient asks you to take part in keeping the truth about surgery from spouse
- Patient treats you or your staff disrespectfully
- Patient appears to have difficulty understanding the recommended course

Body dysmorphic disorder (BDD), as outlined in the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edn (DSM-IV-TR),[10] is one of the common conditions encountered in plastic surgery. Criteria for suspecting a diagnosis of BDD are:

1. preoccupation with an imagined defect in appearance
2. the preoccupation must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning
3. the preoccupation must not have been accounted for by other mental disorders.

Proper patient selection for plastic surgery is not about diagnosing psychological disorders, since we, as plastic surgeons, are not qualified to make such a diagnosis. The skill lies in avoiding hasty surgery on patients who are going to be displeased with the rhinoplasty no matter how good the outcome is. However, our responsibility does not end with avoiding surgery when there is a high degree of emotional disturbance, in the same way as it does not end when one suspects cardiac disease that may render surgical procedures unsafe. In the latter scenario, every conscientious surgeon will insist on the patient seeking advice from a cardiologist and will not, whatever the circumstances, ignore the symptoms and merely end the discussion with 'You are not a good candidate for surgery'. When a psychological disorder is suspected, it is the responsibility of the surgeon to guide the patient to receive the appropriate psychological care. Merely declining the surgery and not directing the patient towards psychological advice will invariably result in the patient finding an inexperienced surgeon who will offer surgery, and an unhappy outcome will ensue. Most patients with psychological conditions are in denial, will not admit that they have any psychological illness, and will not visit a specialist unless it is made part of the conditions for undergoing rhinoplasty. An oral covenant will, in an informal way, obligate the surgeon to undertake the surgery as long as a trusted psychiatrist the surgeon examines the patient and approves proceeding with the rhinoplasty. This way, the surgeon is not callously declining surgery and ignoring the fact that there is a medical condition that needs attention. Most patients who seek advice from a specialist come to the conclusion that they do not need surgery. In rare circumstances, the psychiatrist or psychologist may find that, with or without treatment, the patient is suitable to undergo surgery. In this way, most of the negative consequences of declining to perform a rhinoplasty and some of the medicolegal difficulties in operating on someone who is suspected to have a psychological problem are prevented or mitigated.

Statements such as 'I would like my nose to look the way it did prior to the last rhinoplasty', when made by someone undergoing a secondary procedure, are troubling, since the patient originally must have had good reason

for undergoing surgery. The patient who makes a statement such as 'He butchered my nose', when minor flaws are only identifiable on careful scrutiny, indicates someone who is not going to be pleased with any outcome. Repeated, disparaging remarks, or claims that a surgeon carried out something that was not discussed, are, in general, indications of a patient who wants to blame the problem on someone else. Statements of seemingly disproportionate concern are also a significant clue to underlying psychosocial problems. Since such statements are usually subjective, using a numeric system has proven very useful. Asking the patient to score the abnormality of their nose on a scale from 1–10 and judging the degree of disparity between the patient's assessment and one's own can be extremely valuable. If the difference is only 1–2 levels, it is not going to be that important. However, I have actually had patients who scored their noses at a negative value (below 0) even though the nose looked like a 7–8 to me. This kind of disparity in the assessment is a clear and unquestionable sign of unnatural feelings towards the nasal defect and a clear indication of an abnormal psychological frame.

Functional Traps

One of the most common discrepancies between a patient's judgment and the surgeon's findings is related to the nasal airway. In Figure 2.1, the feature common to all three patients is that their lips are open, but none complained of nasal airway occlusion. It is not uncommon for patients to report that they do not have breathing problems even though they are clearly mouth-breathers. Such patients are accustomed to mouth-breathing and do not know that there is another way of respiration for them.

Careful observation of the nasal valves while the patient is asked to inspire will provide a significant amount of information that cannot be obtained otherwise. Observation of the occlusion may disclose valuable information (Figure 2.32). Patients who have a posterior cross bite often have a narrow and high vaulted palate which is associated with a very narrow nasal airway. This type of airway may deteriorate after a reductive rhinoplasty (Figure 2.33).

Additionally, inquiry into a history of frequent sinus headaches and infections and migraine headaches is crucial in planning to help these patients and preventing the blame for the conditions being placed on the rhinoplasty. Otherwise, these pre-existing conditions may be exacerbated postoperatively.

Many such patients may demonstrate collapse of the external valve on inhalation (Figure 2.34). This can be further confirmed with the use of a speculum or Q tip (Figure 2.35). Additional discussion may uncover the fact that patients can only breathe well if they spread their cheeks apart (Figure 2.36). Failing to recognize the valve dysfunction and support the valves may result in deterioration of breathing.

Figure 2.32 The occlusal view demonstrates posterior cross bite.

Figure 2.33 The palatal view demonstrates a high, narrow palatal vault.

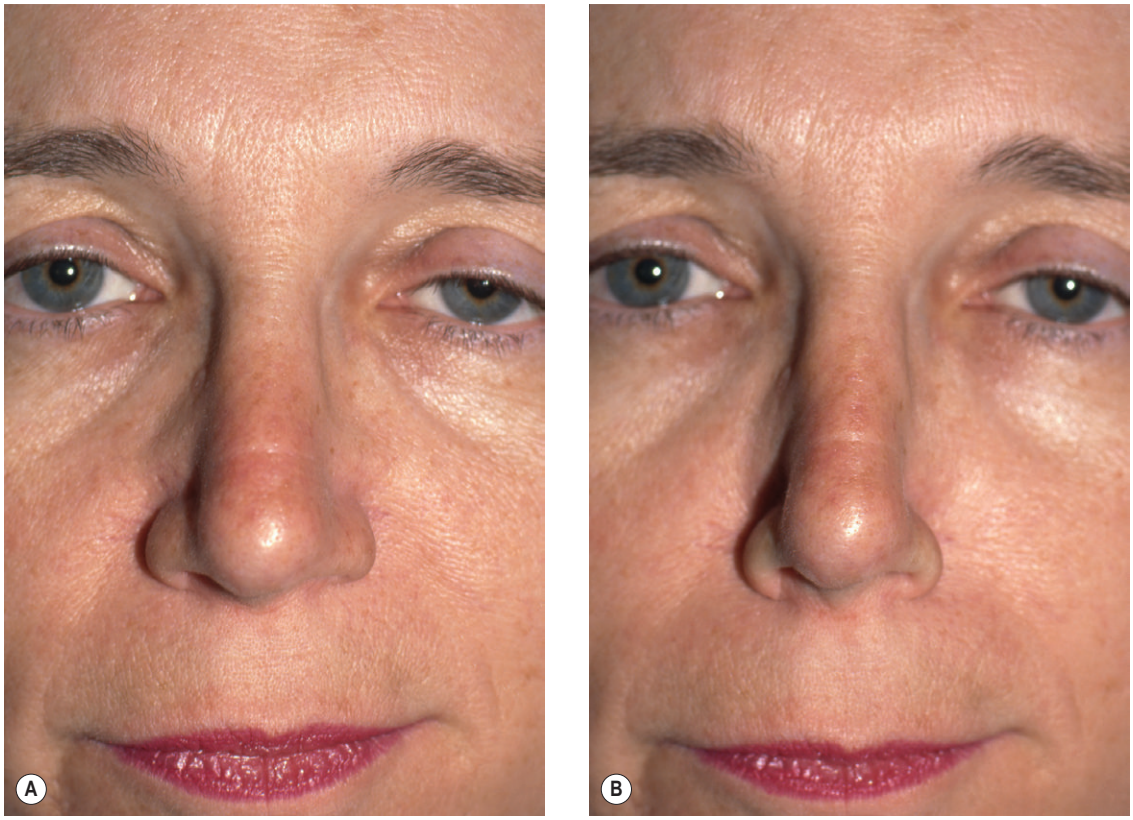


Figure 2.34 A patient demonstrating external valve dysfunction on inhalation.

Figure 2.35 Use of a Q tip and separation to test the valve function.

Figure 2.36 The patient is aiding her internal valves by spreading the cheeks apart.

Figure 2.37 A patient with thin skin.

Figure 2.38 A patient with thick skin.

Form/Anatomy Traps

Anatomical elements one should be aware of include noses that have thin skin (Figure 2.37) or thick skin (Figure 2.38). Both of these patients are going to require specific surgical management.

A tip that is hanging from a large hump is destined to lose a good portion of its projection immediately upon lowering the caudal dorsum. Understanding this potential problem and planning to support the tip with a columella strut or tip graft will prevent a supratip deformity. Inadequate tip projection will be avoided if we carefully watch the patient on animation (Figure 2.39), which commonly demonstrates dependency of the tip and posterior tip retraction upon smiling. This is a clear indication of a hyperactive depressor nasi septi muscle and insufficient tip support.

Patients who have significant excessive width to the nose will require major medial transposition of the upper lateral cartilage as the nasal bone is repositioned centrally. This must be taken into consideration and additional maneuvers should be implemented to protect the function of the internal and external valves and avoid an inverted 'V' deformity as a result of internal valve collapse.

Figure 2.39 A profile view demonstrating significant tip ptosis on animation.

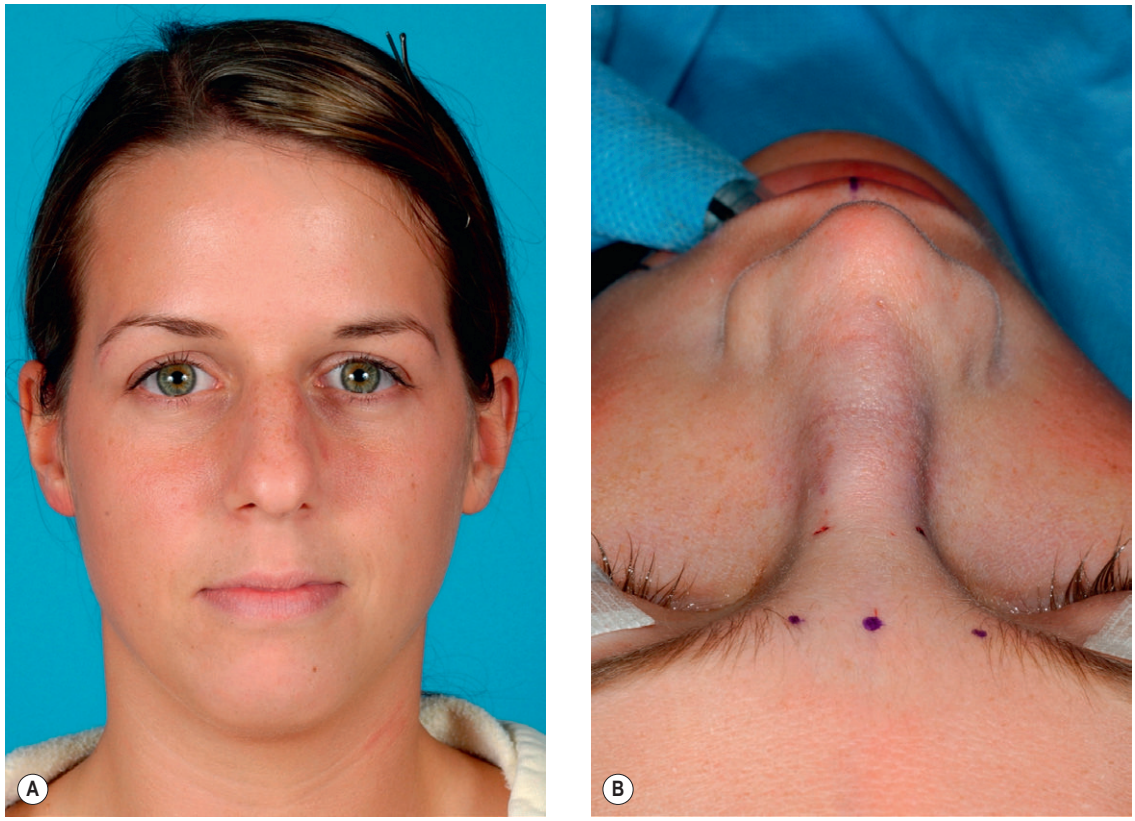


Figure 2.40 Differential plucking of eyebrows to camouflage a deviated nose.

Another potential trap is the way patients with a deviated nose alter their eyebrows. Many of these patients pluck their eyebrows differentially to camouflage the deviation (Figure 2.40). This gives rise to the illusion that the nose is properly lined up with the midline of the eyebrow. Using the midline of the plucked eyebrows to judge the position of the nose during facial analysis and surgery will result in failure to correct the deviation. It is prudent to mark the midline of the glabellar area using the line that bisects the intercanthal distance, as long as the orbits are positioned symmetrically.

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CHAPTER 3

Dynamics of Rhinoplasty

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Pearls

- Different means of achieving the same objectives have their own minor nuances and may entail unexpected additional changes. This makes a precise understanding of rhinoplasty dynamics essential for a successful outcome.
- Cephalic deepening of the radix will result in elongation of the nose while deepening at the level of the canthus, and caudal to it, may make the nose appear shorter.
- Deepening of the radix will induce the appearance of an increased intercanthal distance.
- Augmentation of the radix will render an appearance of reduced intercanthal distance.
- Reduction of the dorsum will engender an appearance of a wider nose while its augmentation will result in a nose that appears narrower.
- Osteotomy of the nasal bones will result in the appearance of a narrow nose and a decrease in intercanthal distance.
- Osteotomy and medial repositioning in the nasal bone may result in medialization of the upper lateral cartilage. The longer the nasal bone, the greater the effect that will be transferred to the upper lateral cartilage.
- When the cephalic margin of the lower lateral cartilages is trimmed, the domes will be separated, resulting in bossae. Furthermore, the tip will slightly rotate cephalically and if the resection is aggressive, it can result in retraction of the ala. Placement of an interdomal, lateral crura spanning, or medial genu suture will prevent this.
- Removal of the cephalic margin of the lower lateral cartilages, lowering or removal of the domes, transection of the lateral crura, medial crura, or both, tip setback anchor suture, lowering the anterocaudal septum,

nasal spine reduction, and maxillary setback will all result in reduction in tip projection.

- A tip narrowing can be achieved through interdomal, transdomal, lateral crura spanning, and anterior medial crura sutures. The tip can also be narrowed using a tip graft and domal interruption as a last resort.
- The tip can be widened through an interdomal or subdomal graft A wide onlay graft can be used if the aesthetics of the nose make it advisable.
- Increase in tip projection can be achieved through a tip graft, columella strut, transdomal suture, approximation of the footplates, medial crura anchor suture to the anterocaudal septum, nasal spine augmentation, maxillary advancement, and Fred technique.
- Cephalic rotation of the tip can be achieved through anterocaudal septum resection along with the membranous septum reinforced with a tip rotation suture, removal of the cephalic margin of the lower lateral cartilages, placement of columella strut, footplate approximation, and nasal spine augmentation.
- Nasal dorsal reduction may provide an optical illusion that the tip has been rotated cephalically.
- A nasal spine graft will result in shorter upper lip, an increase in tip projection and widening of the nasolabial angle.
- Reduction of the nasal spine will result in a longer appearance of the upper lip, narrowing of the nasolabial angle, and reduction in tip projection.
- Approximation of the footplates will result in augmentation of the tip projection, narrowing of the base of the columella, and slight cephalic rotation of the tip, and caudal advancement of the subnasale.
- Reduction of tip projection can result in widening of the alar base and bowing of the columella caudally.
- Narrowing of the alar base will not only result in reduction of the nostril width, it will also transpose the alar rim caudally.
- Placement of the alar rim graft will eliminate alar concavity, reposition the alar rim caudally, increase the nostril length and widen the nostril which will improve the function of the external valve.

One of the factors that makes rhinoplasty a continuous challenge is the complicated dynamic interplay that occurs with each maneuver, resulting in additional changes that may or may not be in agreement with the aesthetic goals.[1–2] When a number of maneuvers are carried out simultaneously, the associated changes with each maneuver become difficult to predict, thus creating an enigma for the surgeon. Knowledge of these effects garnered through experience and reading the related literature will ultimately lead to more predictable rhinoplasty outcomes.

There are also several ways of achieving the same objective. However, there are minor nuances associated with each maneuver, and thus they cannot be used interchangeably. In this chapter, we will discuss the cause and effects and related dynamics in each zone of the nose, the knowledge of which is crucial for a successful rhinoplasty. We shall discuss each zone of the nose separately.

The Radix

One of the least understood and most underestimated aspects of a rhinoplasty is the role of the junction of the nose and forehead in facial aesthetics. Especially in this era where a conservative rhinoplasty is emphasized, excessive alteration of this site can dramatically change the patient's appearance. Augmentation of the radix results in the appearance of a reduced intercanthal distance and elongates the nose.

Animation 3.1 •

Depending on how cephalad the deepening of the radix is, a different outcome can be expected (Figure 3.1; Animation 3.1). More cephalad deepening will

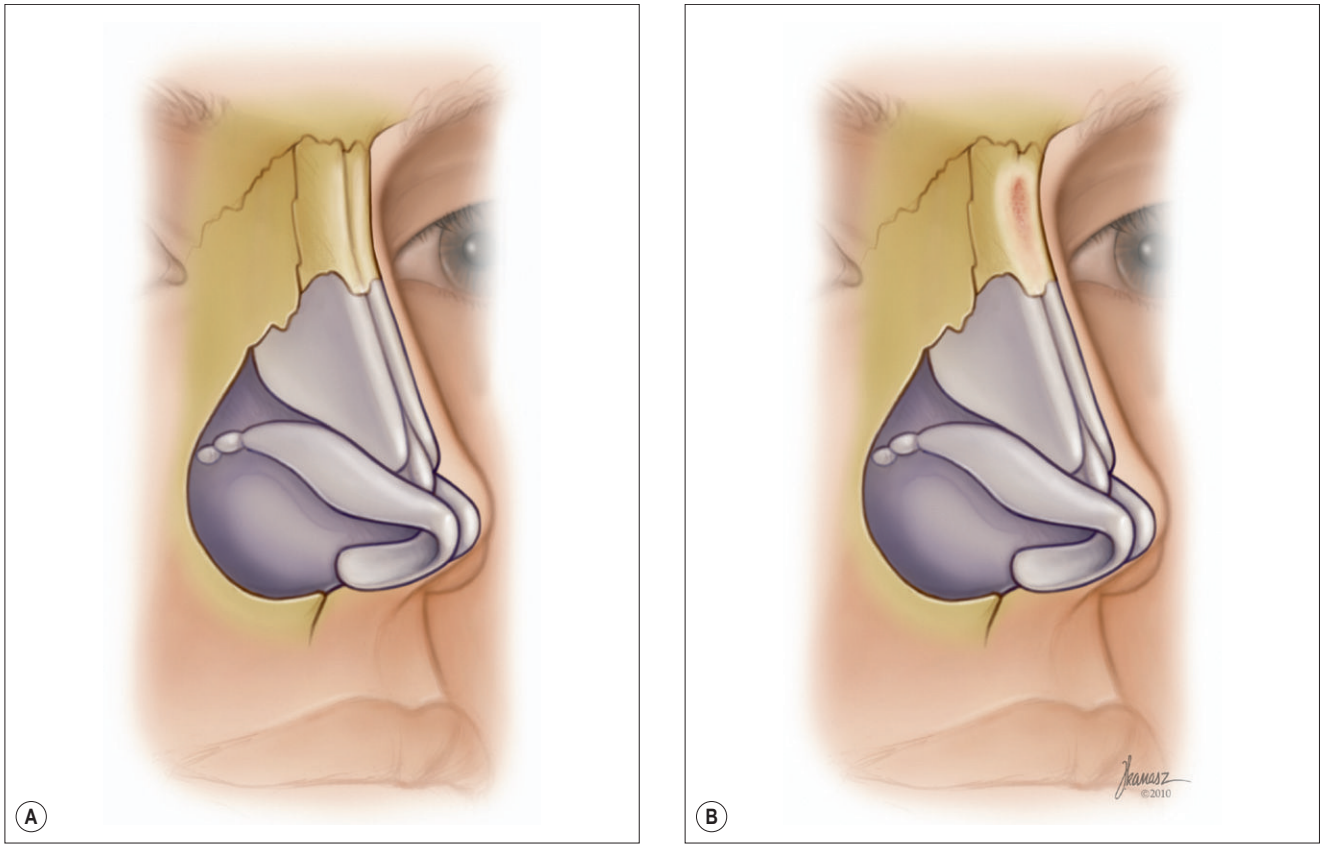


Figure 3.1 As the radix is deepened, if the deepening is cephalad, it will result in elongation of the nose.

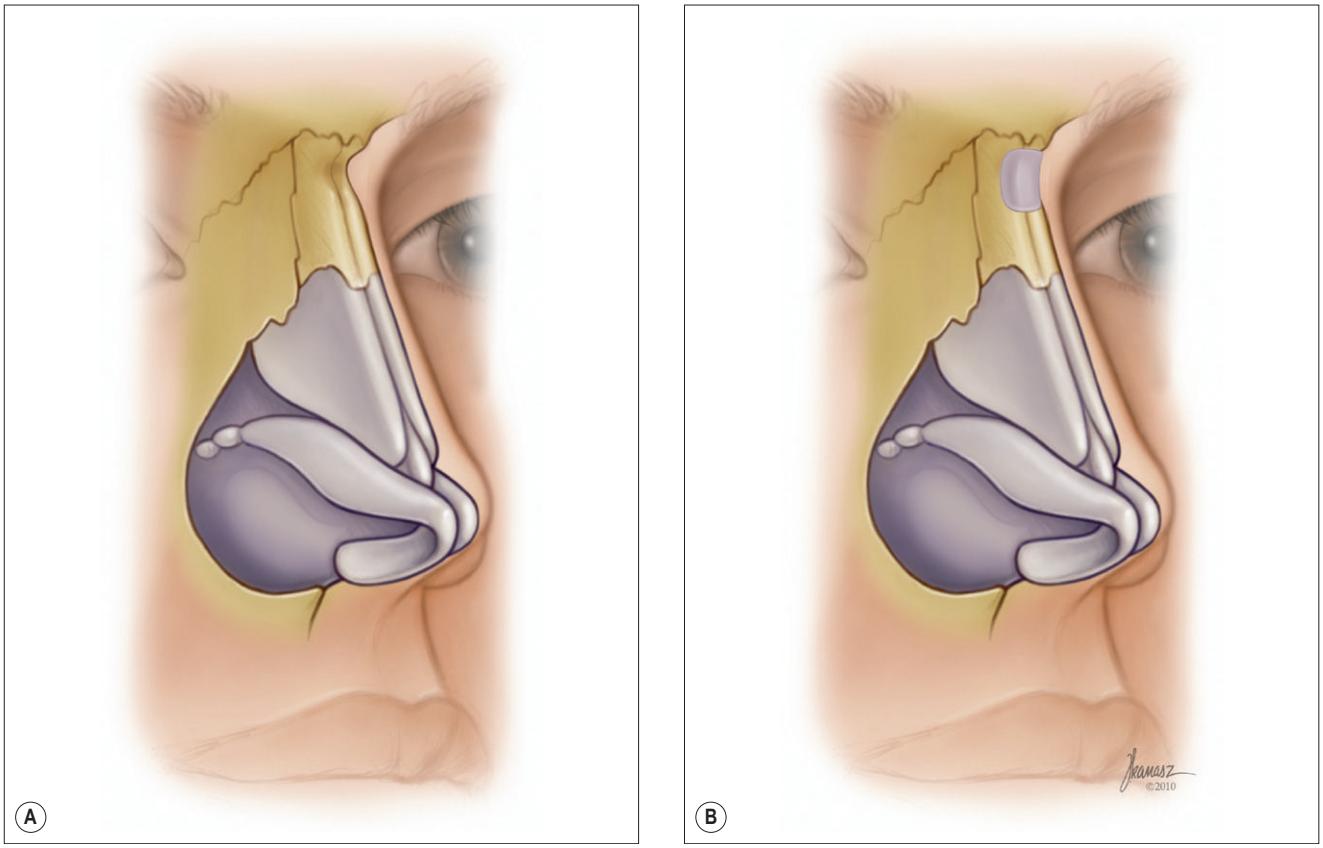


Figure 3.2 As the radix is augmented, it will result in elongation of the nose.

result in elongation of the nose, while deepening at the medial canthus or caudal to it will produce a shorter appearance in the nose. This is very intriguing in that both augmentation and reduction can potentially make the nose look long, depending on the site of deepening (Figure 3.2; Animation 3.2). Deepening of the radix will induce the appearance of an increased intercanthal distance.

Animation 3.2 •

The Dorsum

The presence of a dorsal hump provides the appearance of a narrower bridge. As the hump is removed, the dorsum will appear wider even after an osteotomy and narrowing of the distance between the nasal bones (Figures 3.2, 3.3). Additionally, removal of the dorsal hump provides an appearance of increased intercanthal distance. Augmentation of the dorsum will have a reverse effect: the dorsum will look narrower and the intercanthal distance

Figure 3.3 A wider appearance of the nose following removal of the dorsal hump and osteotomy.

Figure 3.4 A narrow appearance of the nose after application of a dorsal graft.

will appear shorter as long as the graft utilized is not too wide (Figure 3.4). Osteotomy of the nasal bones will result in the appearance of a narrower nose and a decrease in the intercanthal distance (Figure 3.5).

Furthermore, osteotomy and medial transposition of the nasal bone and the upper lateral cartilage (ULC) may also reduce the nasal airway. However, this change will be more drastic when the nasal bones are longer, which will have more influence on the ULC (Figure 3.6; Animation 3.3) if the nasal bones are transposed medially to a significant degree (Figure 3.7) or if the inferior turbinate extends anterior to the plane of osteotomy (Figure 3.8). To avoid medialization of the inferior turbinates, one may start the osteotomy more anteriorly or do a high to low osteotomy (Figure 3.9). Alternatively, one may

Animation 3.3 •

Figure 3.5 Osteotomy and medial positioning of the nasal bones will cause the appearance of a reduction in the intercanthal distance and the nose will seem narrower.

perform a conservative inferior turbinectomy.[3] Avoiding an osteotomy is an option, but in most instances this is not an acceptable aesthetic compromise. Furthermore, in order to reduce the ill effects of the medialization of the ULC on the nasal valve and dorsal aesthetic lines, insertion of spreader grafts may become necessary. If the removed dorsal hump is small enough to avoid an open nasal roof, spreader grafts may not be necessary unless there is a primary internal valve dysfunction. When removal of a small dorsal hump results in minimal opening of the roof, preservation of the mucoperichondrium may make it unnecessary to use spreader grafts to prevent medialization of the ULC. However, whenever a large dorsal hump is removed, it invariably results in medial transposition of the ULC, which may not be initially discernible. It may take between 6 months and a year for the inverted 'V' deformity to

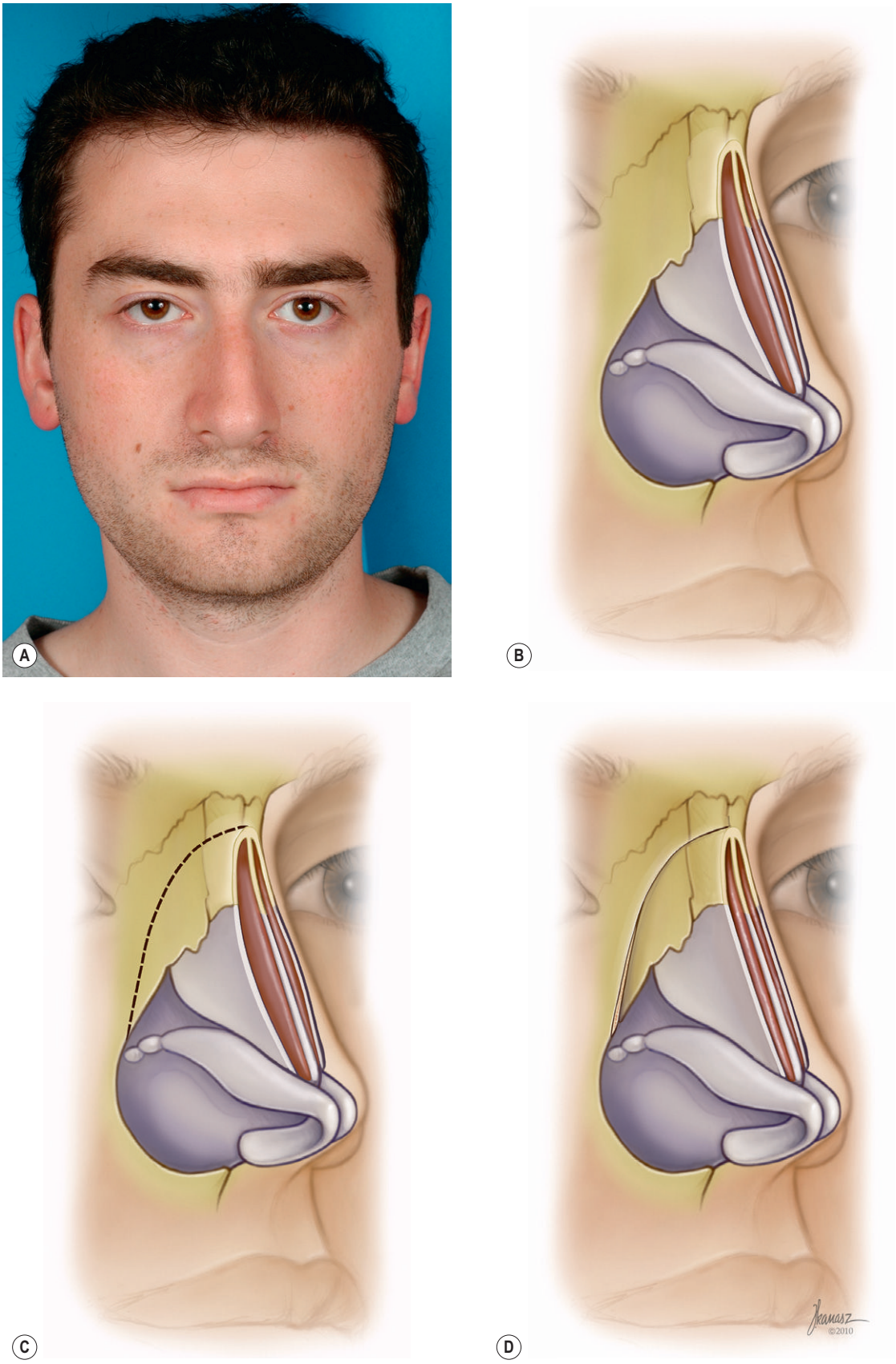


Figure 3.6 The patient in this photograph has long nasal bones and will experience more reduction in the area related to medial transposition of the upper lateral cartilage. The illustration demonstrates the transposition of the nasal bones and the ULCs as a result of an osteotomy.

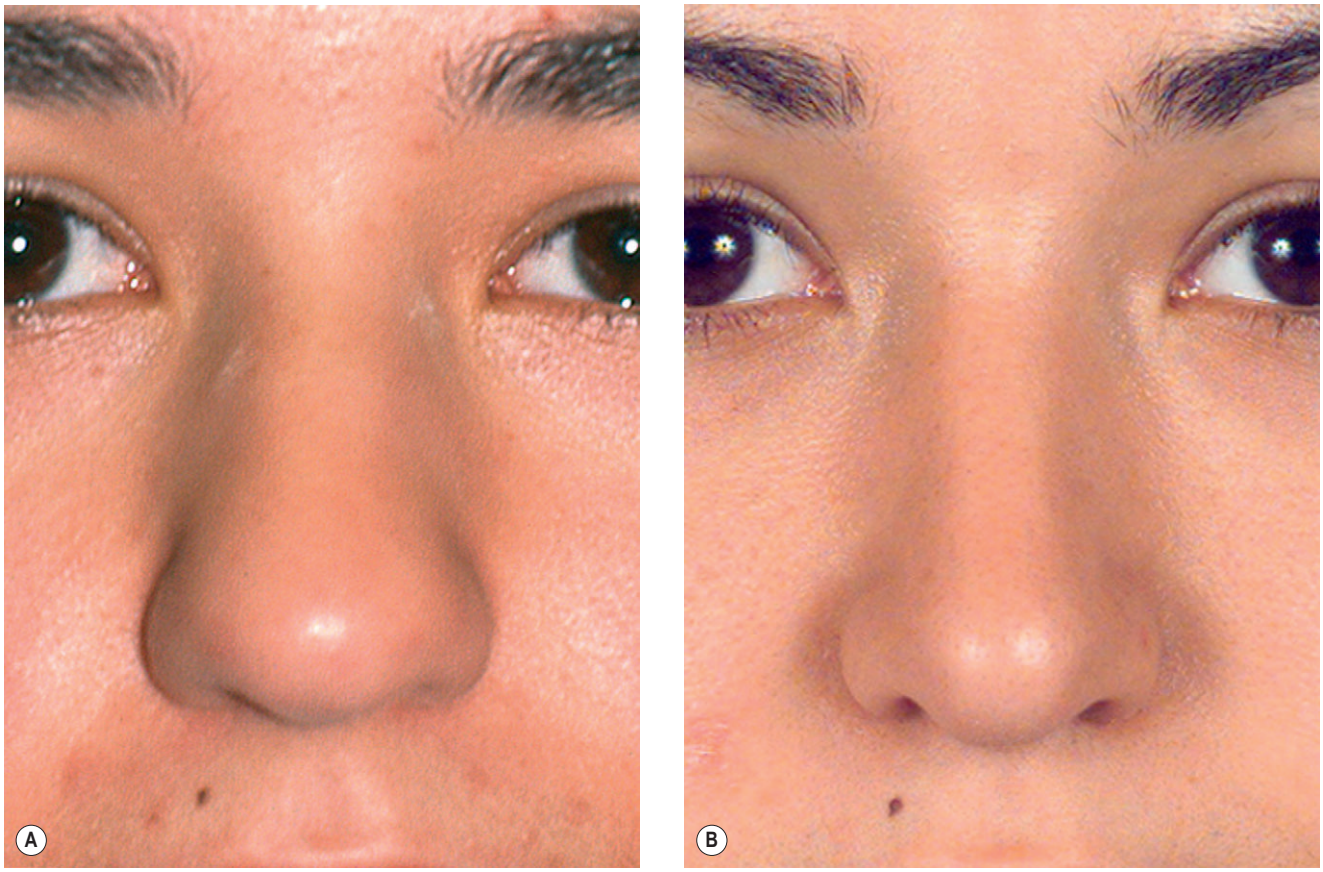


Figure 3.7 The more the nasal bones are medialized as demonstrated in this patient's before and after surgery photographs, the greater the chance of substantial narrowing of the airway.

become visible. It is thus prudent to use bilateral spreader grafts or flaps whenever a large dorsal hump is removed. While in most instances spreader grafts will be sufficient, in rare cases when the ULCs are extremely short or attenuated a splay graft may provide a better functional outcome.[4]

Removal of the Cephalic Margin of the Lower Lateral Cartilages

When the cephalic margin of the lower lateral cartilages is trimmed, by virtue of the elimination of the fibrous bands between the domes which are often attached to the cephalic margin of the domes, the domes will separate (Figure 3.10; Animation 3.4). This is detrimental to the tip configuration. In

Animation 3.4 •

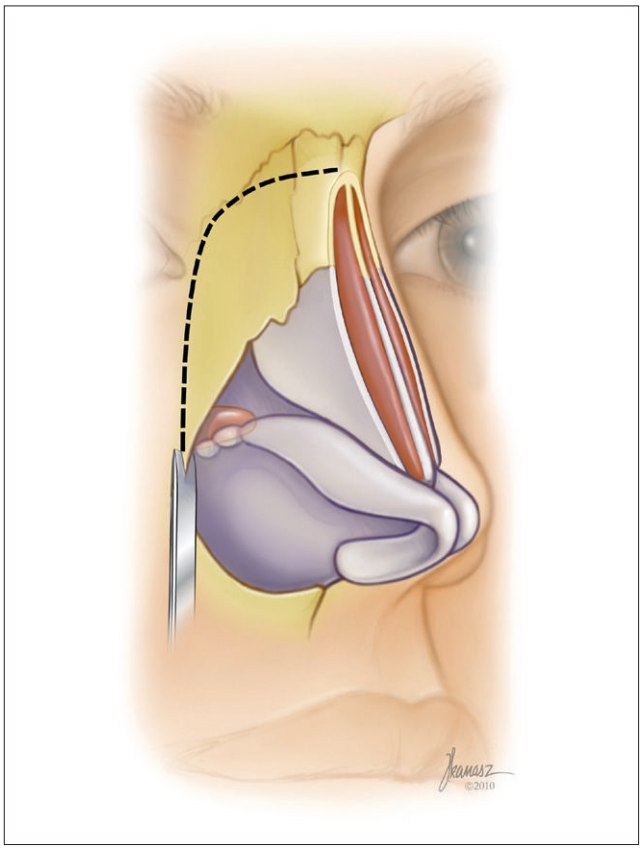


Figure 3.8 Whenever the inferior turbinate is positioned anterior to the plane of the osteotomy, moving the bone medially will medialize the inferior turbinate.

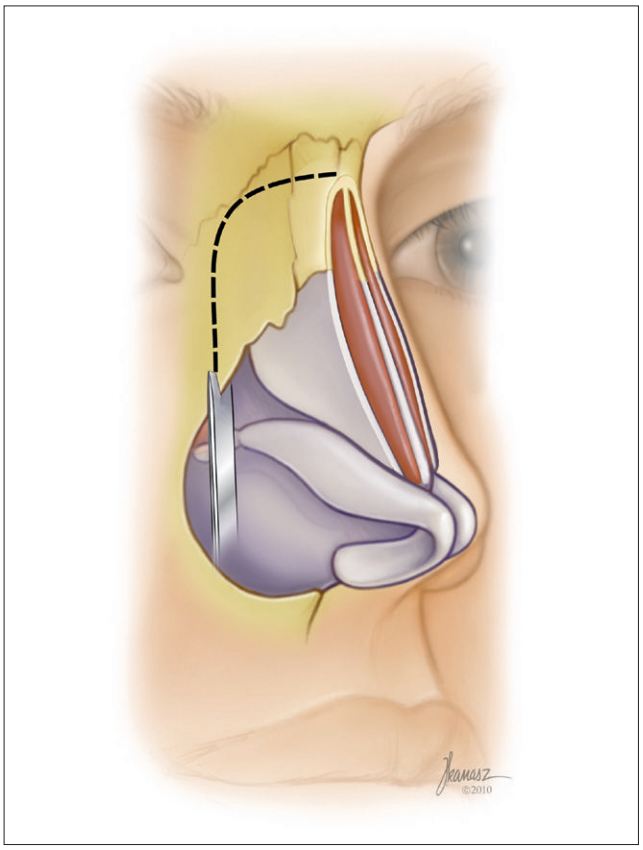
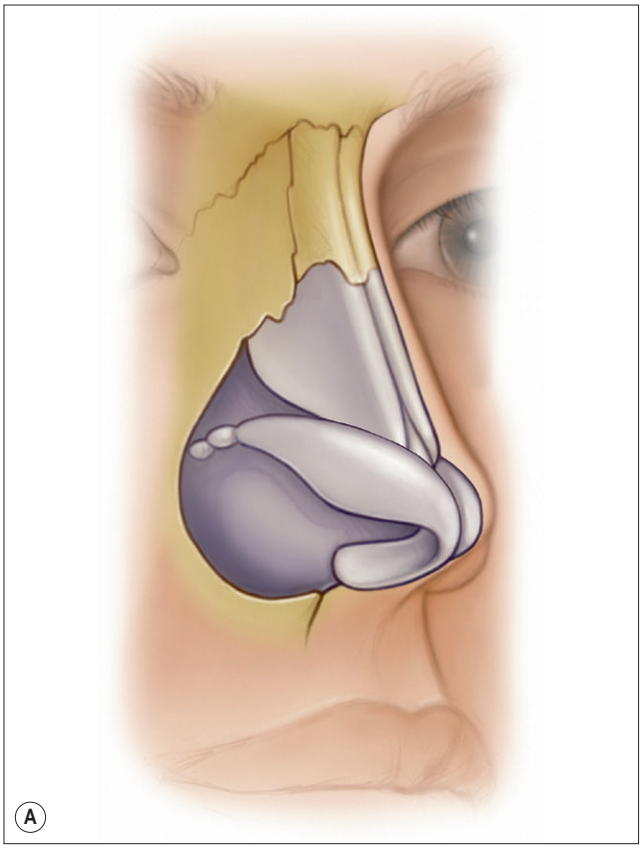


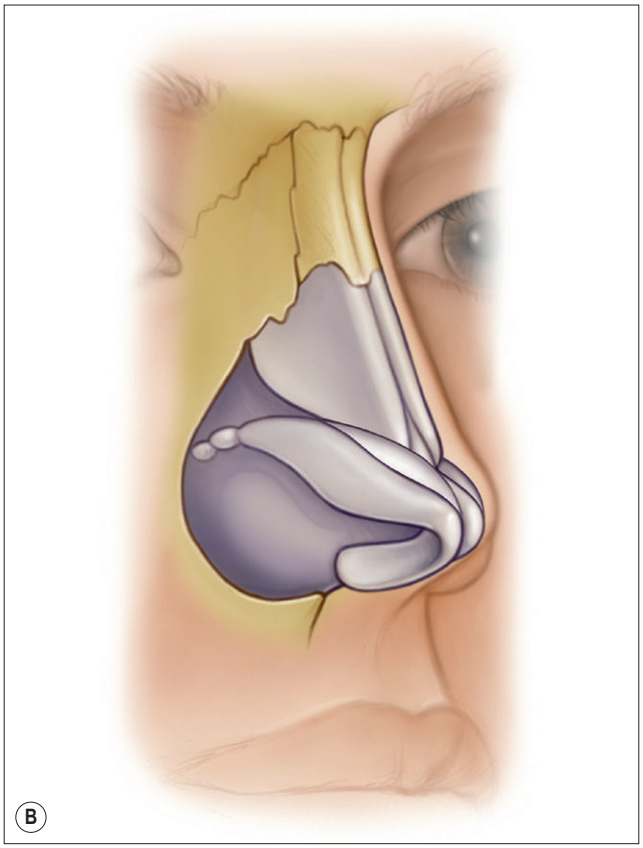
Figure 3.9 In order to avoid medialization of the nasal bone, the osteotomy is started anteriorly and continued posteriorly (high to low).

order to avoid such a widening, which commonly results in bossae seen on secondary rhinoplasty patients (Figure 3.11), one has to use some means to control the distance between the domes such as an interdomal suture, a lateral crura spanning suture, or an anteriorly placed medial crura suture (Figure 3.12).

Reduction of Tip Projection

The tip projection can be reduced in one of several ways. The tip projection will be reduced following a cephalic trim of the lower lateral cartilage but only if the lateral crus is oriented cephalically. This anatomical configuration places the cephalic border of the lateral crus anterior to the highest portion





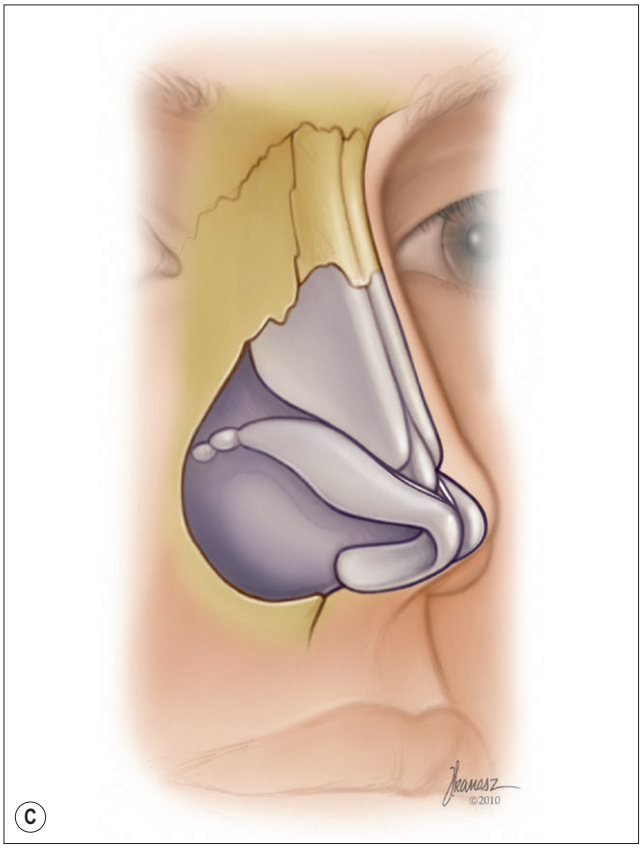


Figure 3.10 Because of the removal of the fibrous bands between the domes, removal of the cephalic margin of the lower lateral cartilages will result in an increase in the distance between the domes.

Figure 3.11 Development of bossae following cephalic trimming of the lower lateral cartilages.

of the domes. Therefore, the most projected portion of the tip on this anatomical variation is not the domes (Figure 3.13). This change is often minimal.

Another means of reducing the tip projection is removing the domes. This is highly destructive and should be reserved for occasions when there is significant overprojection of the tip with excess domal width, where narrowing the domes would result in an even further increase in the projection, or when the domes are distorted. In this scenario, the domes can be reduced anteriorly. However, to avoid an unnatural form and altered function, the domes are reduced to a greater degree than the optimal, a cap graft is applied and fixed to the medial crura, and the lateral and medial crura are sutured to the cap graft to restore the continuity of the basal tripod and maintain the external

Figure 3.12 After removal of the cephalic margin of the lower lateral cartilages, a lateral crura spanning suture controlled the domes on the patient above (A, B) and an interdomal suture controlled the distance between the domes on the patient below (C, D).

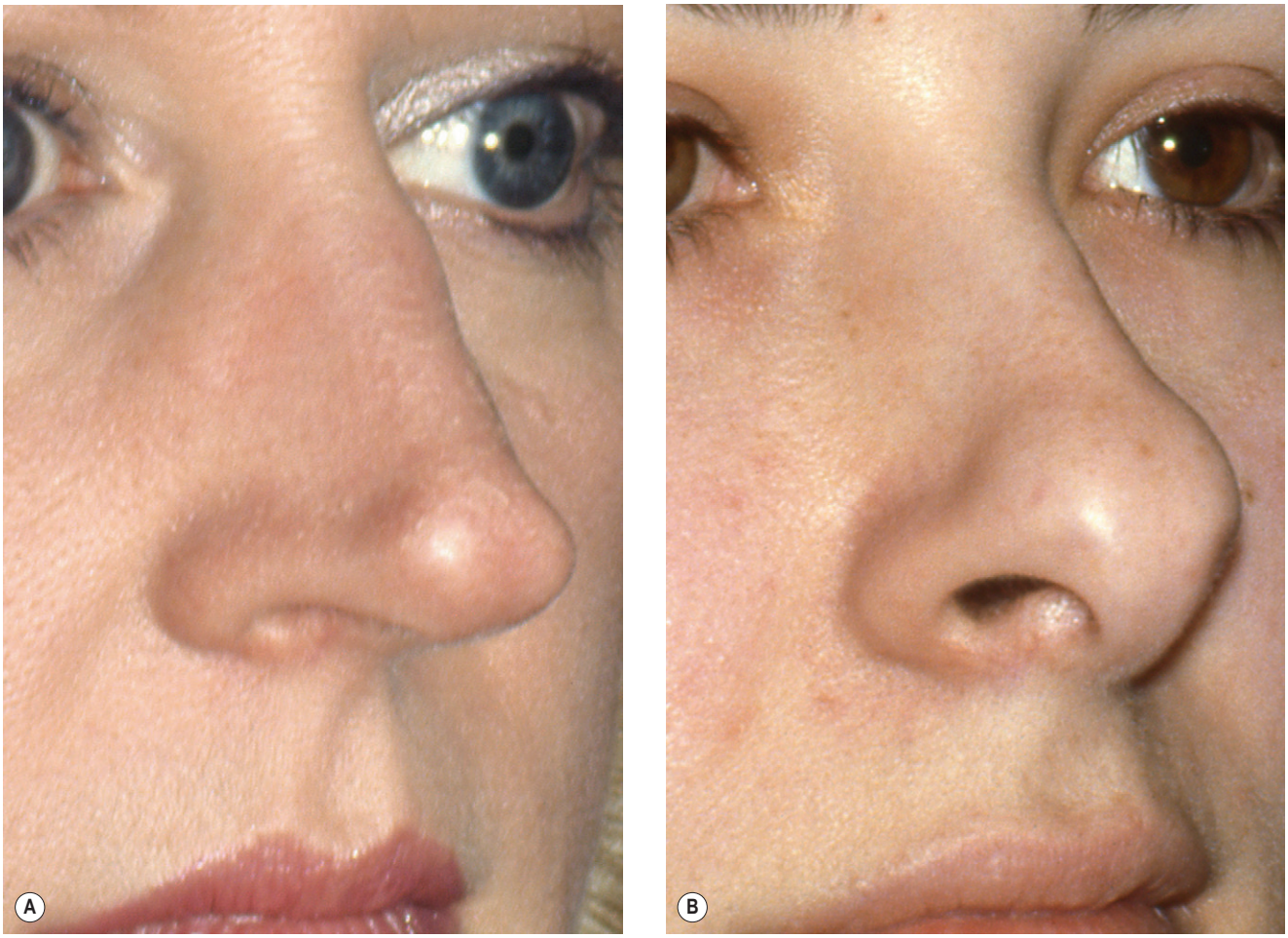
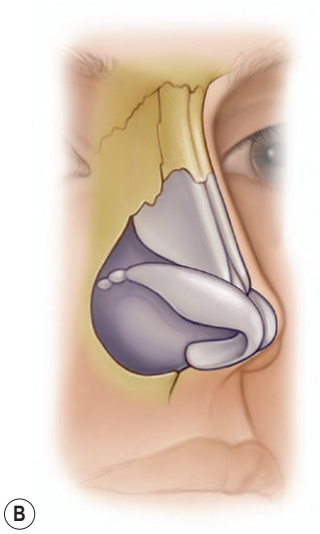


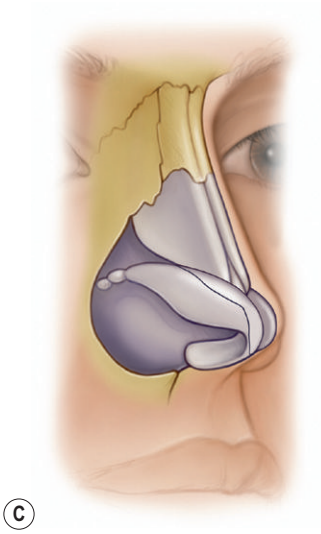
Figure 3.13 The patient on the right (B) has a lower lateral cartilage that is oriented cephalically and the most projected portion of the tip is anterior to the dome. Removal of the cephalic margin of the lower lateral cartilage will result in loss of tip projection in this patient. On the other hand, in the patient on the left (A), the domes are the highest point of the tip and a cephalic trim would not affect the tip projection.

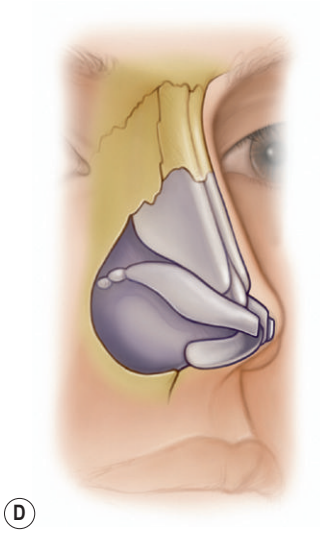
valve function (Figure 3.14; Animation 3.5). On patients who have optimal dome morphology, one can reduce the tip projection by overlapping the lateral and medial crura (Figure 3.15; Animation 3.6). Here, the tripod concept becomes of paramount importance (see Chapter 9).

Animation 3.5 • 3.6

Reduction of the tip projection can also be achieved by anchoring the footplates to the posterior portion of the caudal septum. Here, a suture is passed through the footplates and tied gently, and the needle is passed through the posterocaudal septum and tied incrementally to reposition the domes posteriorly. This commonly results in an unnatural configuration of the junction of the columella and the upper lip (subnasale) and will require adequate soft tissue mobilization to minimize an undesirable shape of the upper lip and columella base.







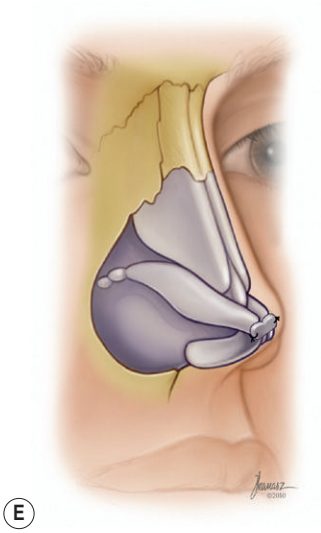


Figure 3.14 (A) This patient has a significantly overprojected tip with a wide nose, so dome reduction can be considered. (B–E) The domes are lowered and reconstructed to restore the resemblance of a normal configuration to the tip.

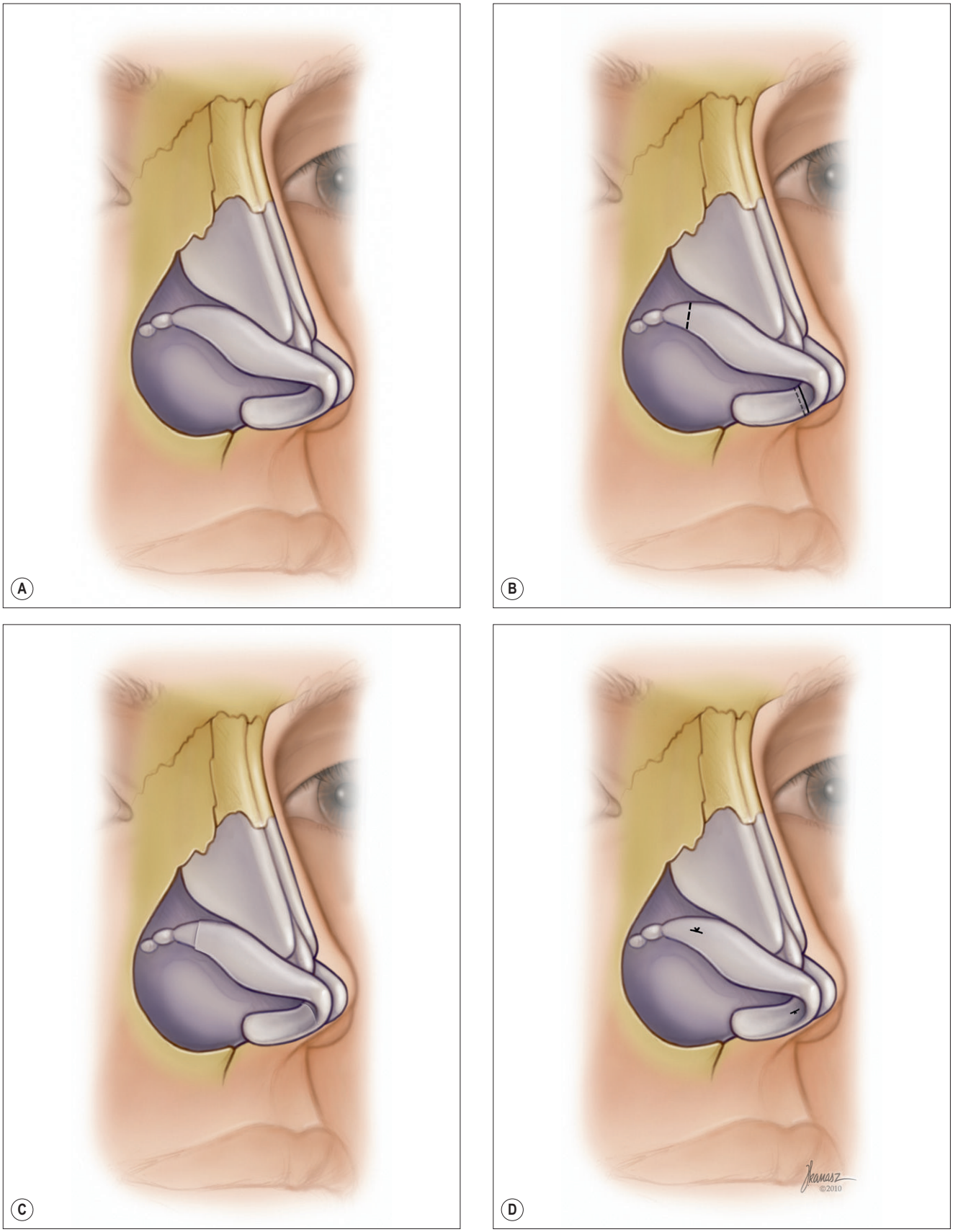


Figure 3.15 By overlapping both the lateral and medial crura equally, the domes can be set back without rotation.

Additionally, this may make the upper lip longer. Commonly, this sort of posterior repositioning of the basal unit will result in narrowing the distance between the domes, which needs to be observed and included in the aesthetic plans. Therefore, the optimal patient for this technique is one with a slightly wide tip with overprojection and excess incisor show (gummy smile).

When a caudal dorsal hump is removed it will result in loss of tip projection, through loss of support of the domes and medial crura. The anterocaudal septum has a very powerful influence on tip projection and must be taken into consideration on an overprojected nose where the domes are suspended from the tip. In this scenario, not only is it not necessary to reduce the tip projection by other means, on occasion one has to add to the tip support because of removal of the dorsal projection (Figure 3.16).

Animation 3.7 •

Tip projection can also be lessened through reduction of the nasal spine (Figure 3.17; Animation 3.7). A similar reduction of tip projection should be anticipated whenever the maxilla is retracted.

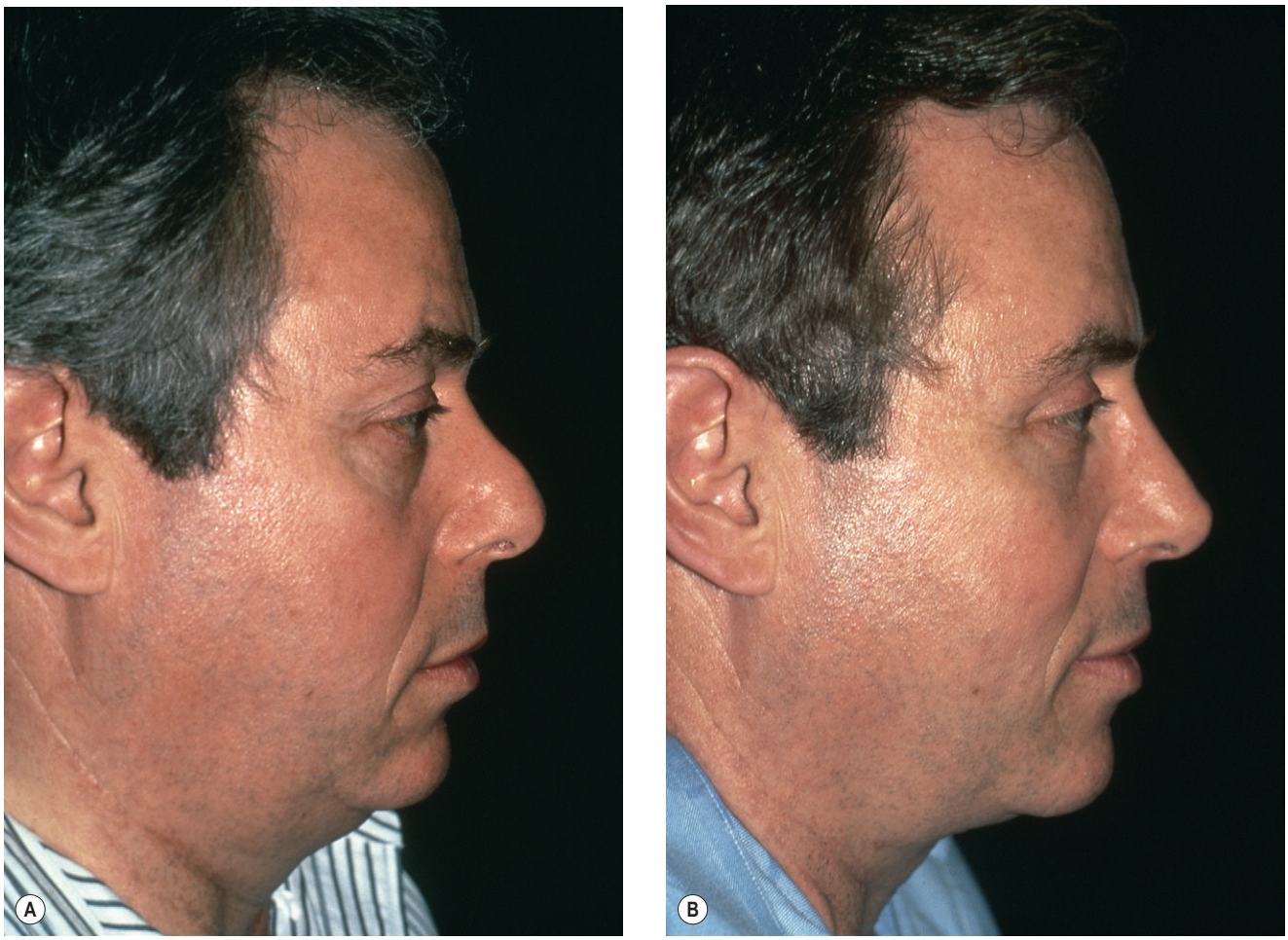
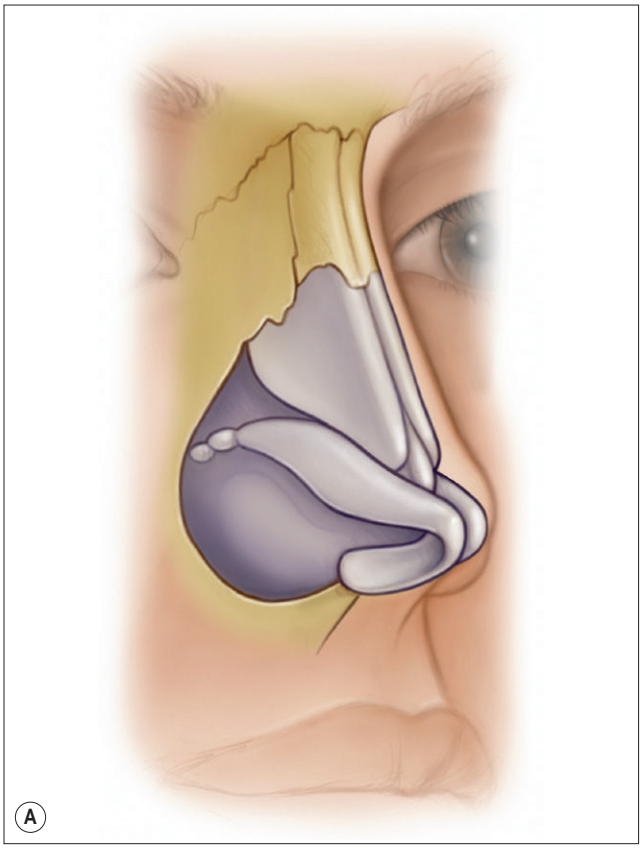
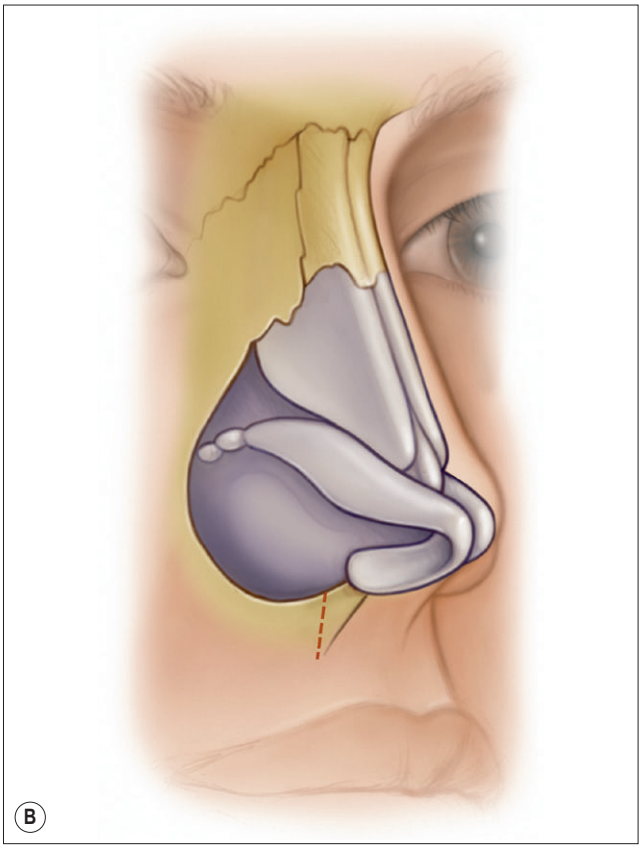


Figure 3.16 On this patient, the tip is hanging from the anterocaudal septum. Removal of the caudal dorsal hump will result in significant loss of tip projection. This patient had to have a columella strut to avoid too much loss of tip support.





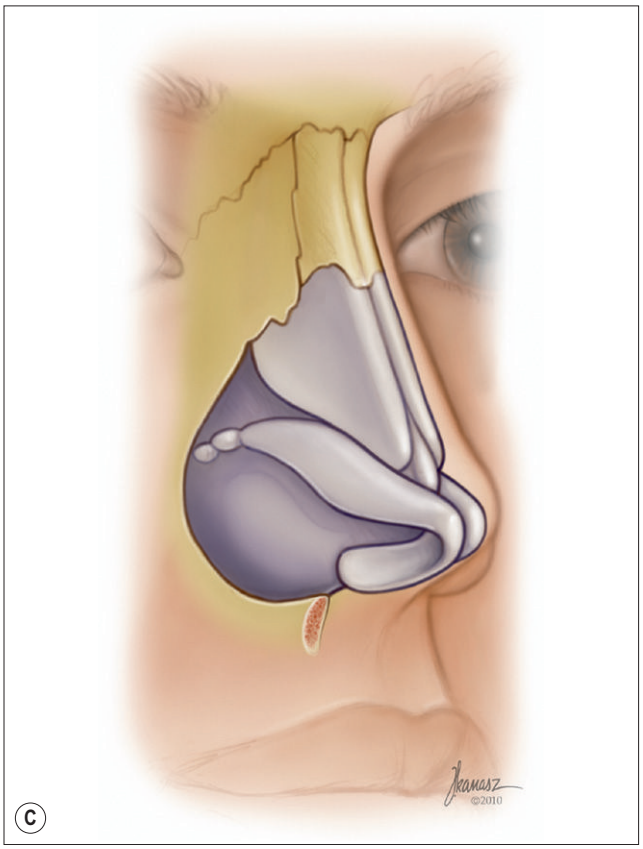


Figure 3.17 Reduction of the nasal spine and anterocaudal septum will result in the loss of tip projection.

Narrowing of the Tip

Removal of a segment of the domes can result in narrowing of the tip on patients who have wide domes. However, this will seldom be indicated. This approach is highly destructive and should be used only as a last resort on patients with an overprojected, wide and malformed tip (Figure 3.18).

Additionally, a narrower tip appearance can be produced by adding a tip graft. The width of the graft governs the width of the tip. The narrower the tip graft, the narrower the tip will appear.

Approximation of the domes using an interdomal suture will also result in narrowing the tip. This is indicated when the domal arches are optimally shaped but they are set too far apart (Figure 3.19).

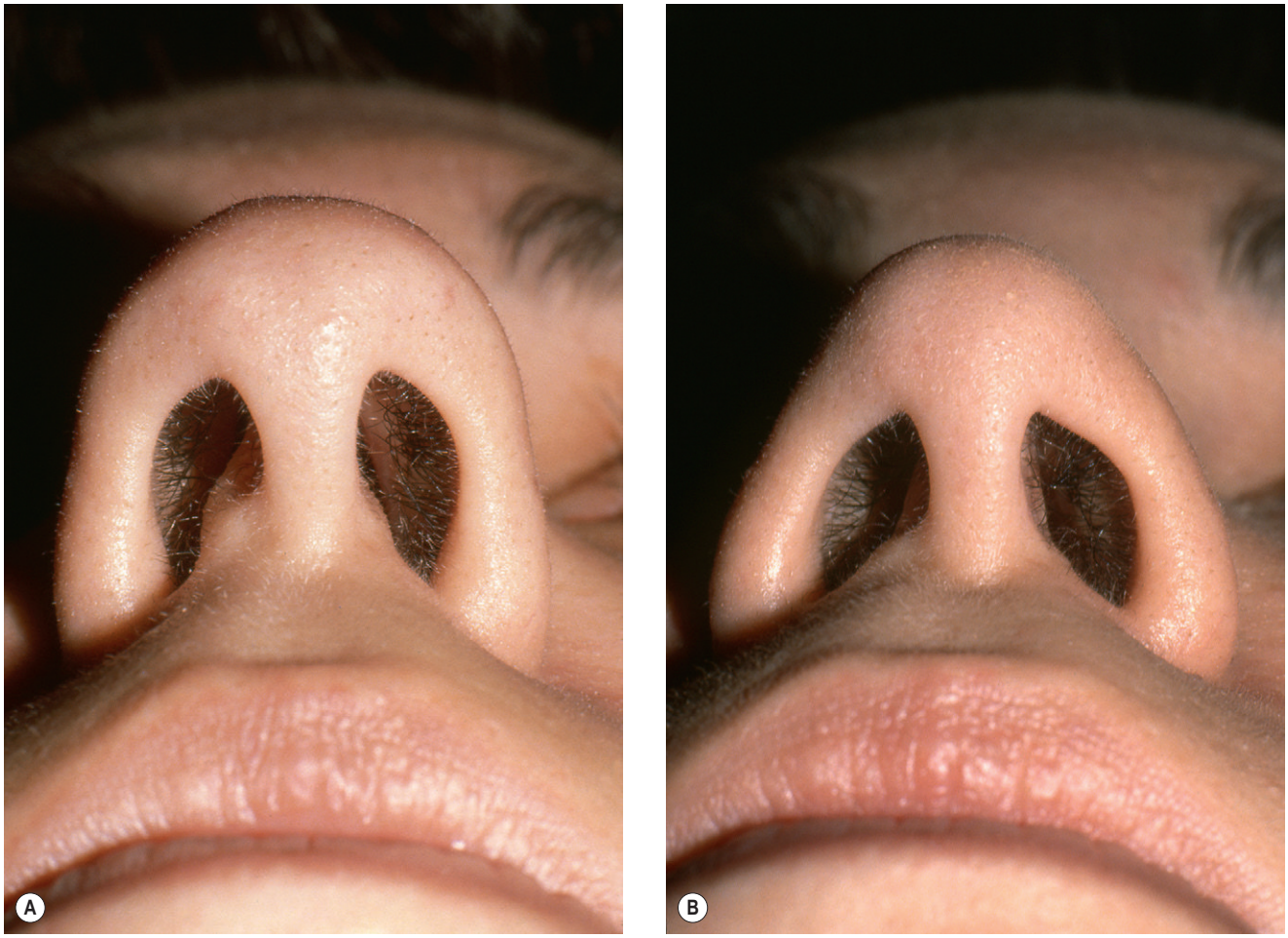


Figure 3.18 A patient with a wide and overprojected tip before (A) and after (B) reduction of the domal width and projection by dome interruption technique, which is not advocated.

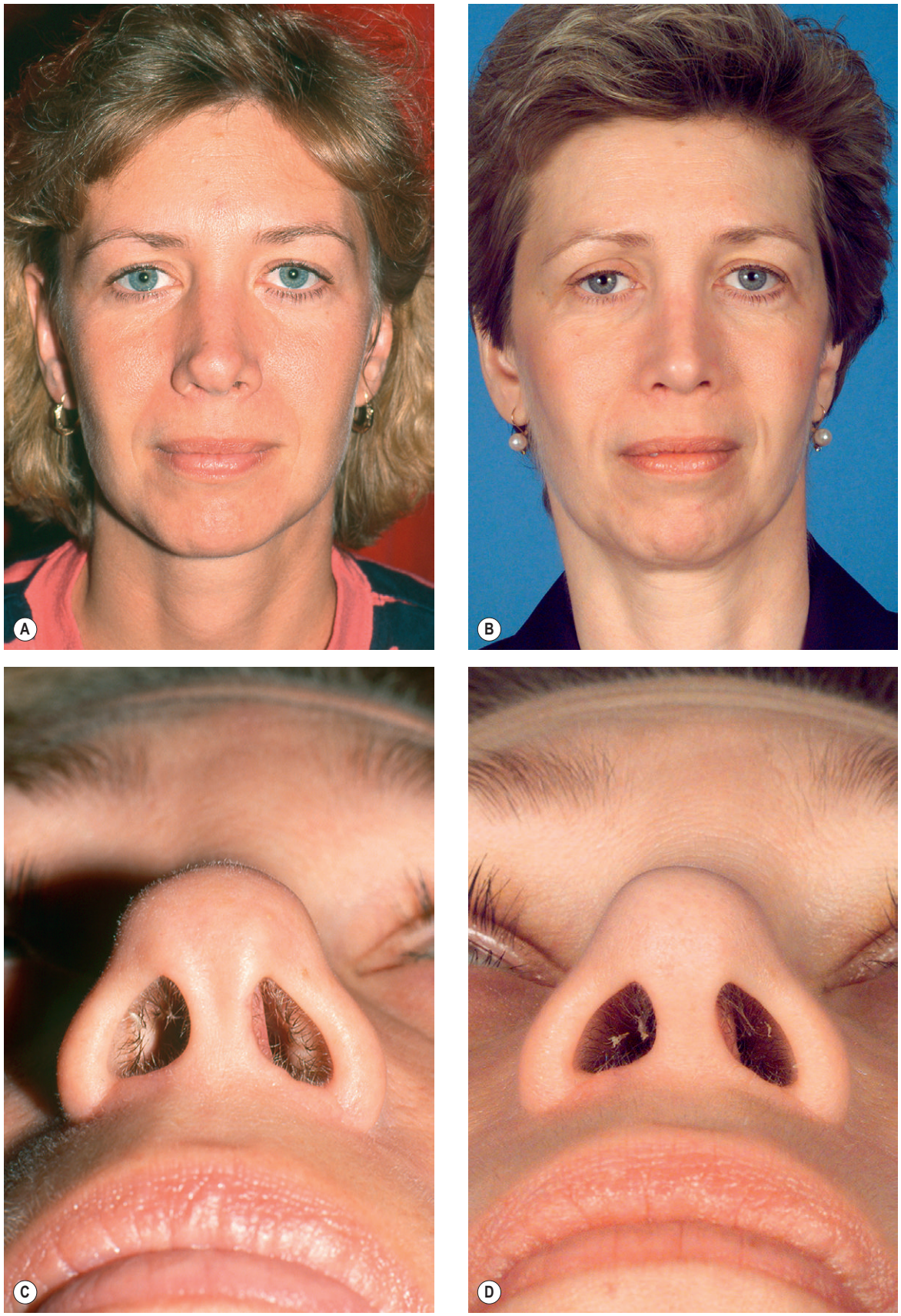


Figure 3.19 (A) Preoperative view of a secondary rhinoplasty patient with the appearance of bossae on the nose tip because of the removal of the cephalic margins many years ago. (B) 10 years following the use of an interdomal suture to reduce the distance between the domes. (C, D) The basilar view of the same patient's nose (C) before the secondary rhinoplasty, with a cleft between the domes reflecting the divergence of the medial crura and (D) 10 years postoperatively, showing correction of clefting and narrowing of the domes.

Animation 3.8 • 3.9

Narrowing the tip can also be achieved using transdomal sutures (Figure 3.20; Animation 3.8). This suture would be used on patients who have an optimal interdomal distance, but the domal arches are too wide (Figure 3.21; Animation 3.9). The medial crura suture, lateral crura spanning suture, and anchor suture, as mentioned earlier, can all reduce the interdomal distance and result in a narrower tip.

Widening of the Tip

The tip can be widened in one of two commonly used ways. If the domal arches are normal but are too close to each other, an interposition graft is placed between the domes (Figure 3.22). For patients who have either narrower than optimal domal arches or domes with an optimal shape but a narrow interdomal distance, a subdomal graft is used (Figure 3.23; Animation 3.10; see Video 4.23 from Chapter 4). A graft is harvested that is approximately 8–10 mm long, 1 mm wide, and 1 mm thick. A pocket is created under each dome and the graft is inserted under one dome and advanced under the opposite one. The graft is sutured in place using 6-0 Vicryl on each side and an interdomal suture is used to control the distances between the domes. On occasion, a wide tip graft can also give the appearance of a wider nose.

Animation 3.10 •

Increasing the Tip Projection

Animation 3.11 •

A tip graft is used to augment the projection if the infratip lobule volume is deficient (Figure 3.24; Animation 3.11).

A columella strut is a better choice for gaining tip projection if the columella is short and tip support at the caudal portion of the tripod is insufficient (Figure 3.25). It is crucial to understand that these two means of attaining extra tip projection are not interchangeable. The tip projection can also be increased with an anchor technique. This is the reverse of the technique discussed for reducing the tip projection. The footplates are sutured to each other lightly, the needle is passed further anteriorly through the caudal septum, and the basal unit is lifted by tying the suture incrementally. This suture will result in minimal separation of the domes, which should be noted and corrected if necessary (Figure 3.26; Animation 3.12).

Animation 3.12 •

The tip projection can also be increased with augmentation of the nasal spine. Whenever the support of the base of the columella is increased, it results in an increase in tip projection (Figure 3.27; Animation 3.13). This includes maxillary augmentation or advancement with an osteotomy.

Animation 3.13 •

Figure 3.20 The transdomal suture is used for a patient who has a normal interdomal distance but the domal arches are too wide.

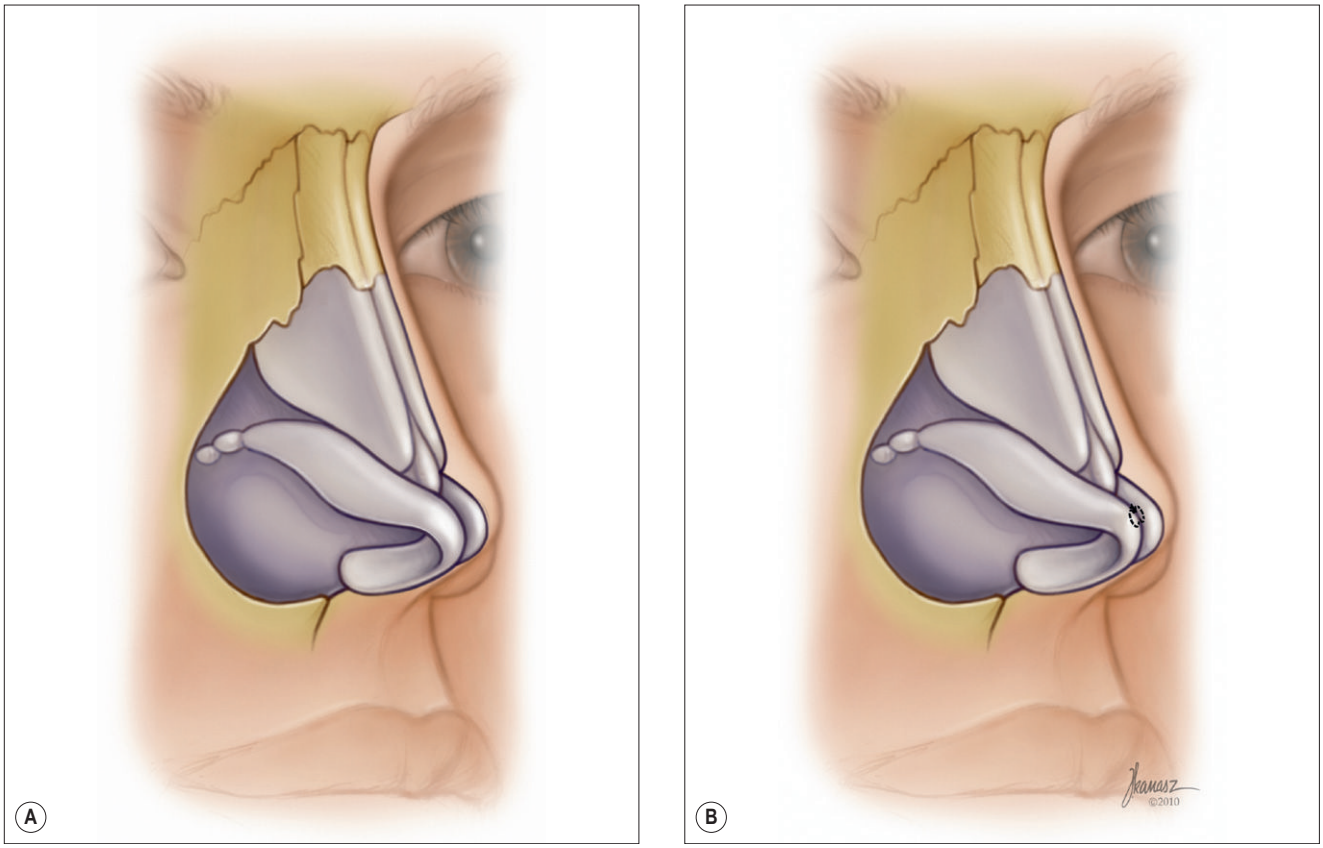


Figure 3.21 Interdomal sutures are used to approximate domes that are too far apart. These sutures may also equalize the domes.

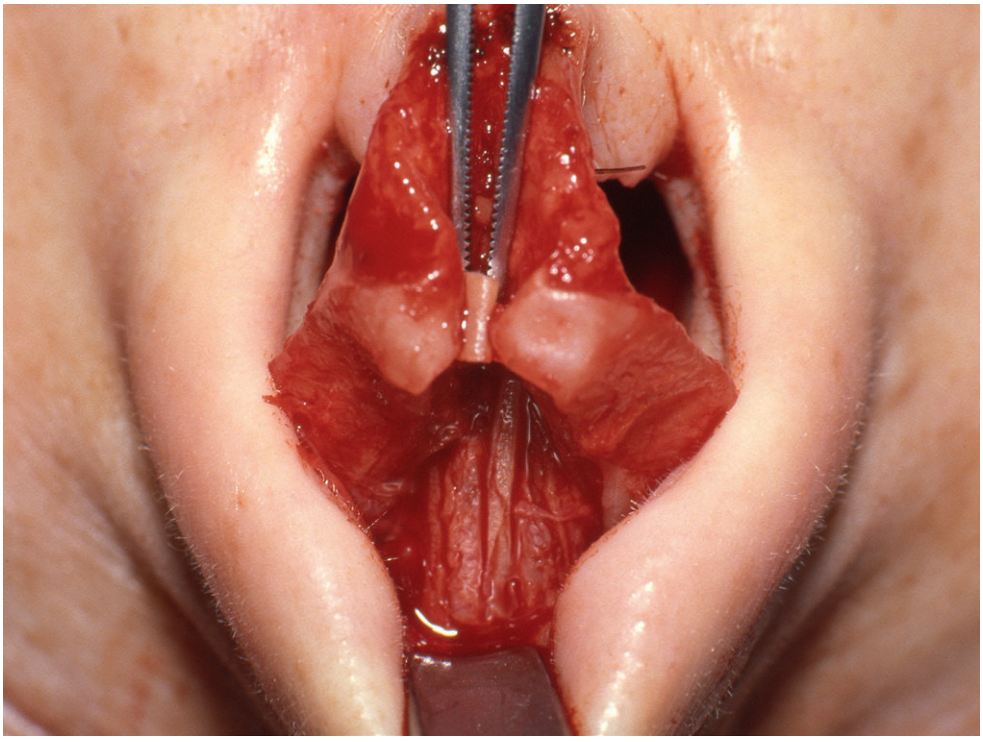


Figure 3.22 An interdomal graft is being applied to a tip that has normal domal arches that are too close to each other.

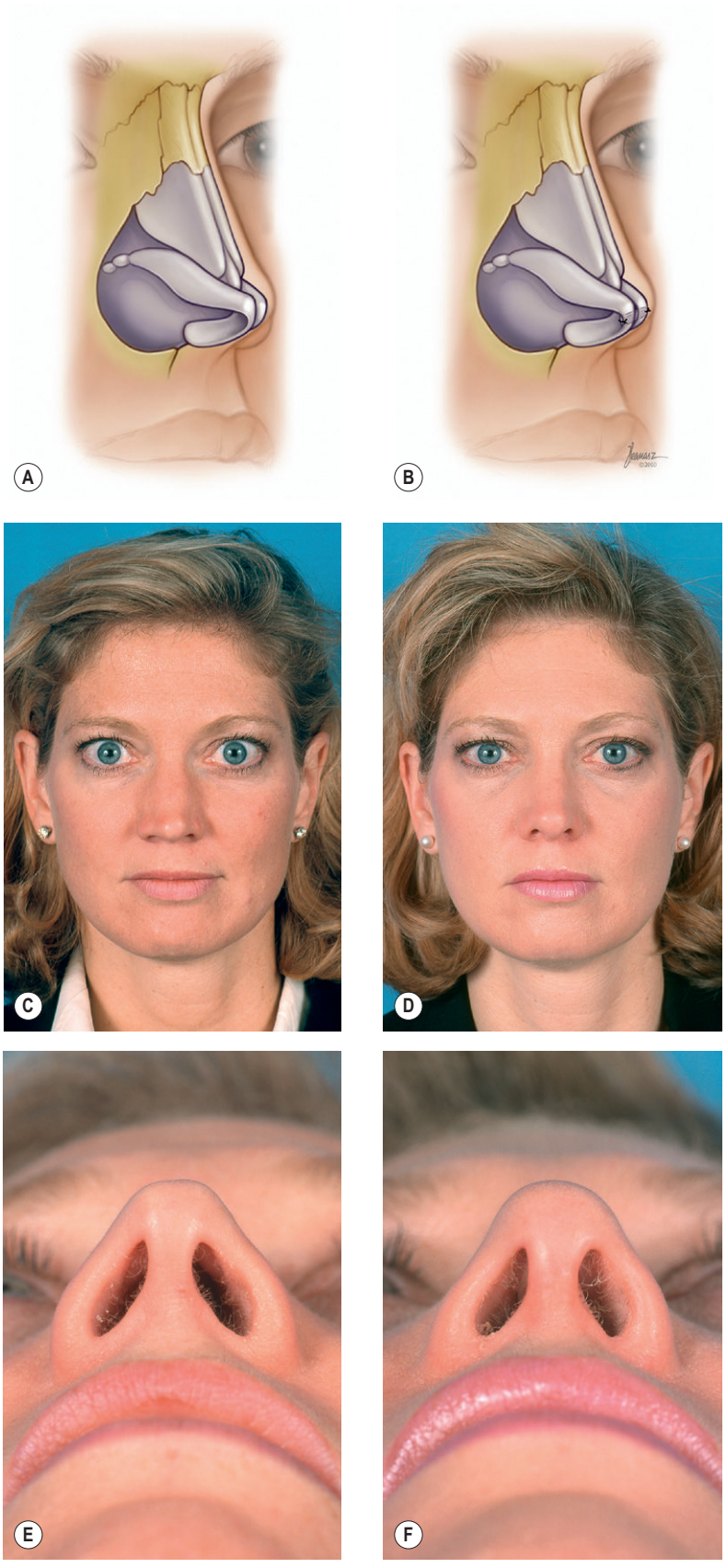


Figure 3.23 A narrow tip before (A) and after (B) placement of the subdomal graft. Example of a patient before (C) and after (D) placement of the subdomal graft on the front and basilar (E, F) views.

Figure 3.24 A patient before (A, C) and 16 years after (B, D) augmentation of tip projection with a combination of a tip graft and columella strut.

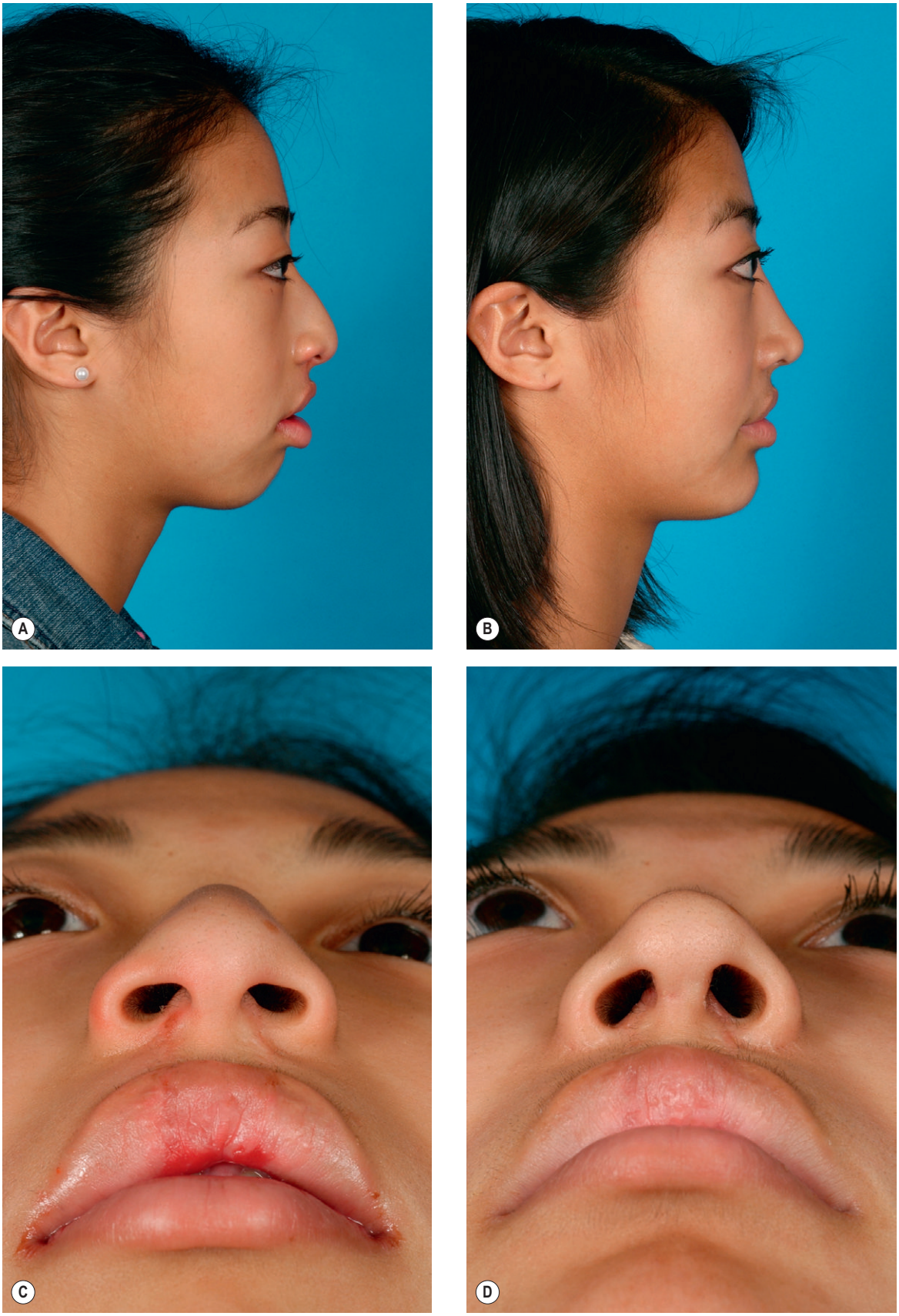


Figure 3.25 A patient with a short columella before (A, C) and after (B, D) placement of a columella strut to elongate the columella and gain more projection.

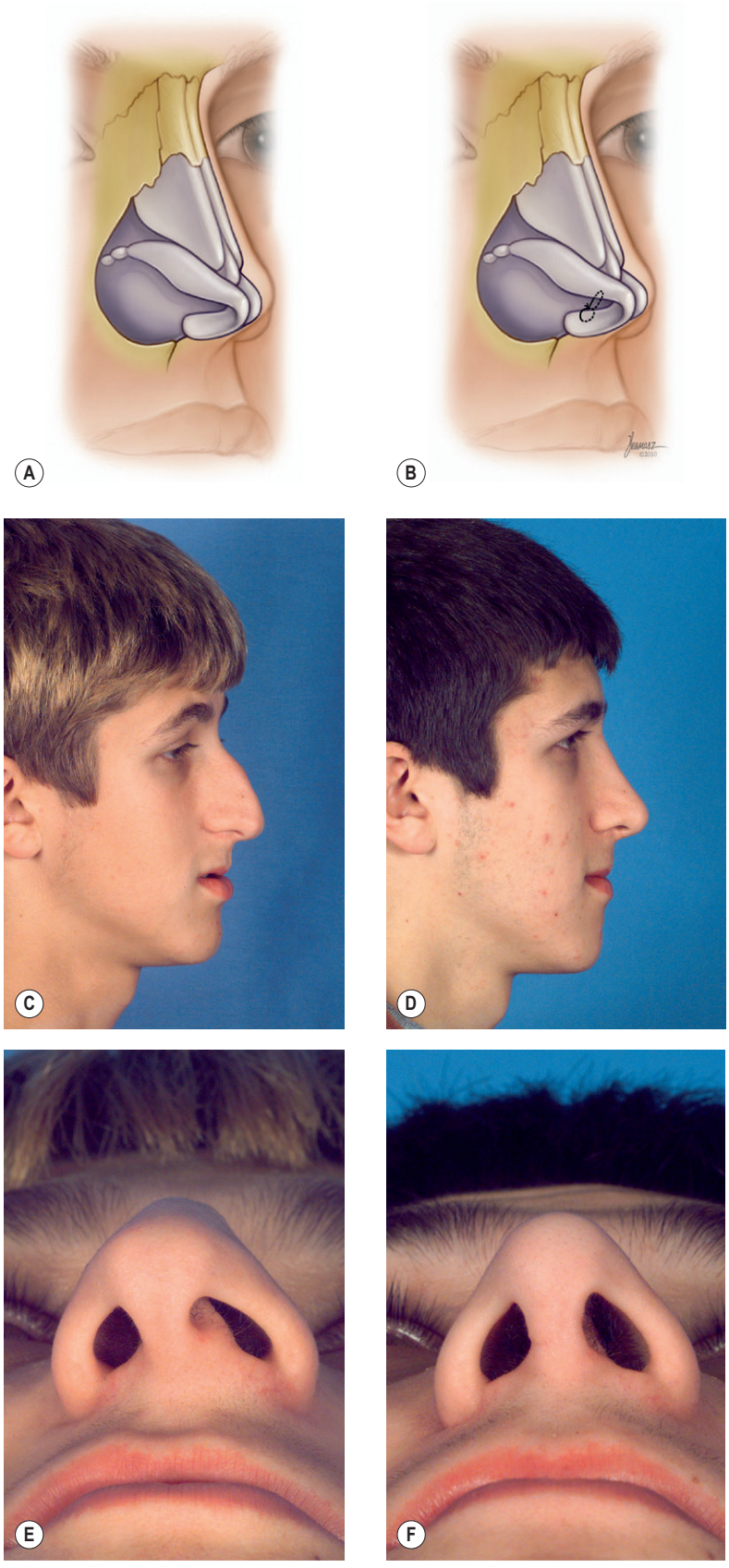


Figure 3.26 Illustration of correction of underprojection while placing a suture through the medial crura (A) and anchoring through the anterocaudal septum (B). Patient with underprojected tip hanging from anterocaudal septum before (C, E) and after (D, F) placement of an anchor suture.

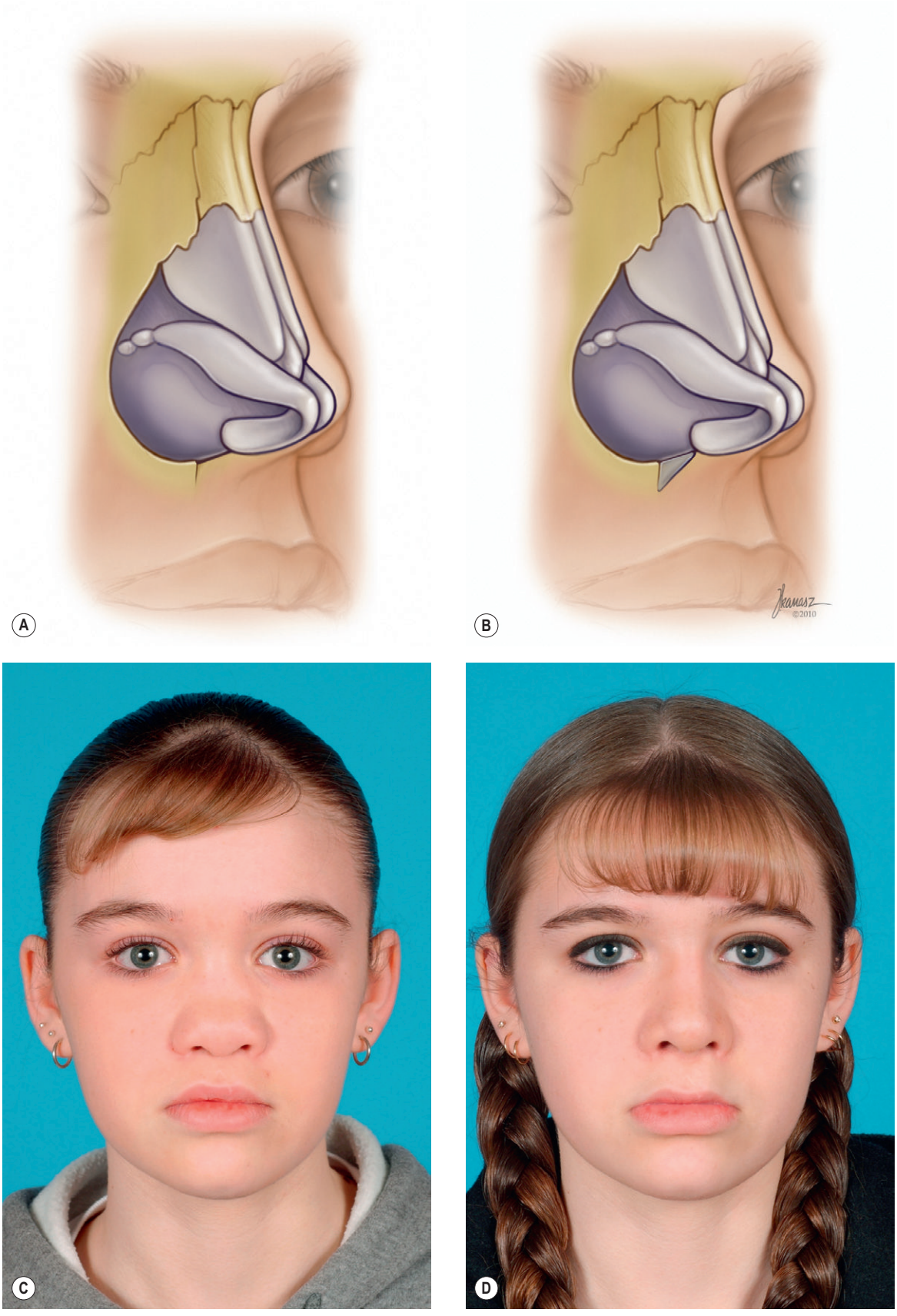


Figure 3.27 An illustration of maxillary augmentation (A, B). Patient with Binder syndrome before (C, E, G) and after (D, F, H) augmentation of the anterior nasal spine area and premaxilla, as well as placement of a columella strut.

Figure 3.27, cont'd.

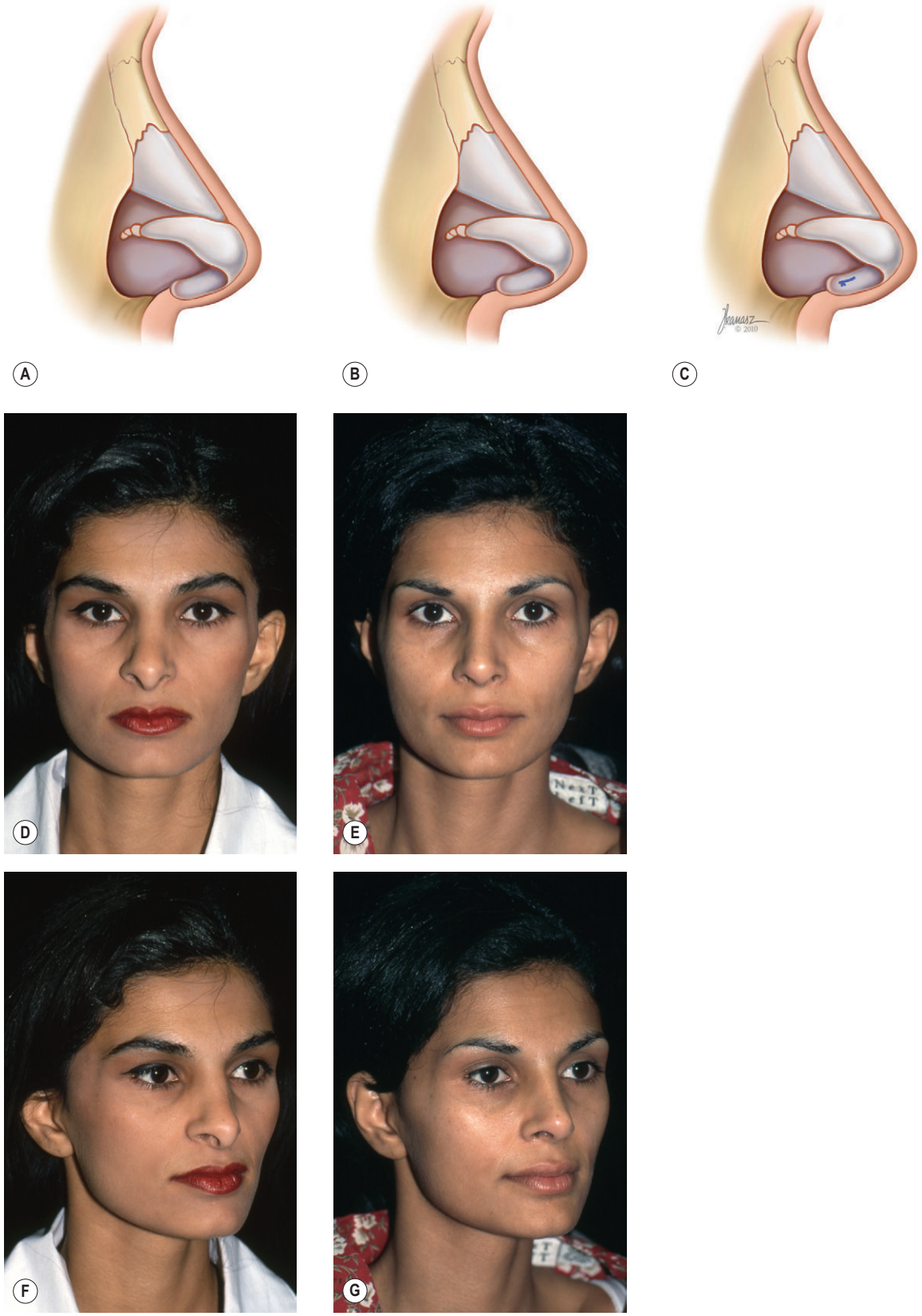


Figure 3.28 Illustration of separation of the medial crura, advancement over the anterocaudal septum and fixation with a Fred suture (A, B, C). A patient before (D, F, H) and after (E, G, I) the Fred technique to retract the hanging columella and advance the medial crura on the caudal septum to gain more projection.

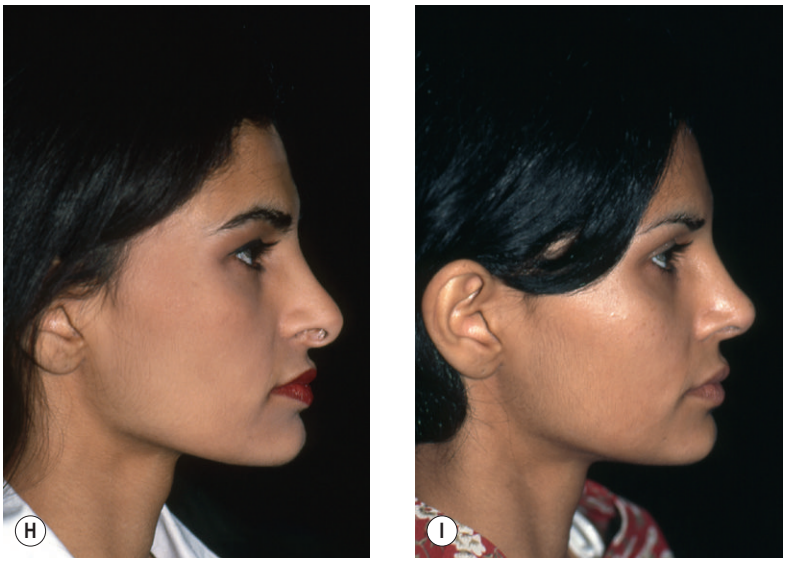


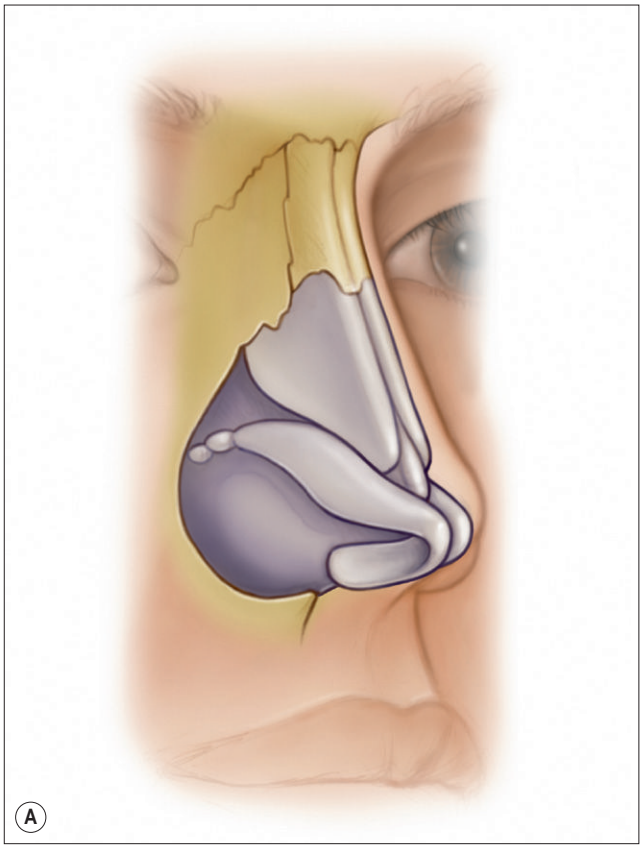
Figure 3.28, cont'd.

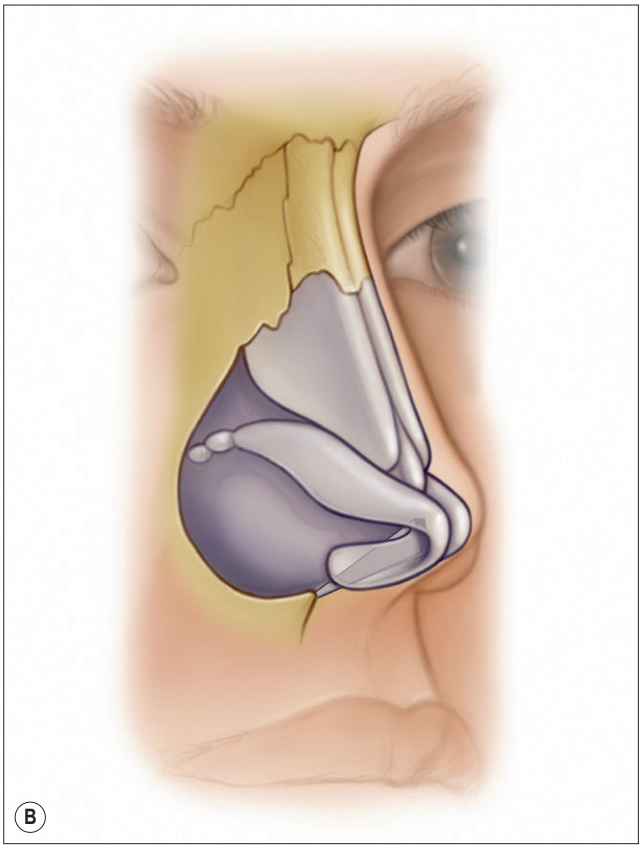
Gustavo Fred[5] has also described a technique whereby the medial crura can be separated and advanced over the caudal septum and sutured in place more anteriorly to gain more projection and help retract the hanging columella. This technique is only suitable for someone who has a hanging columella and inadequate tip projection (Figure 3.28; Animation 3.13).

Cephalic Rotation of the Tip

Animation 3.14 • 3.15 • 3.16 •

The most effective, predictable, and reproducible means of cephalic rotation of the tip is removal of a wedge from the anterocaudal septum based anteriorly (Figure 3.29; Animation 3.14). However, along with this, one has to remove a proportional amount of redundant membranous septum lining and commonly use a tip rotation suture to secure the tip in position (Figure 3.30; Animation 3.15).[6] The tip also minimally rotates cephalically as a result of removal of the cephalic margin of the lower lateral cartilages (Figure 3.31; Animation 3.16). Cephalic rotation of the tip can also be a consequence of placement of a columella strut, and approximation of the footplates results in advancement of the subnasale caudally and a slight rotation of the tip cephalically. Additionally, augmentation of the nasal spine not only increases the tip projection, it may also appear that the tip is rotated cephalically (Figure 3.32). A similar effect can often occur following lowering of the dorsum.





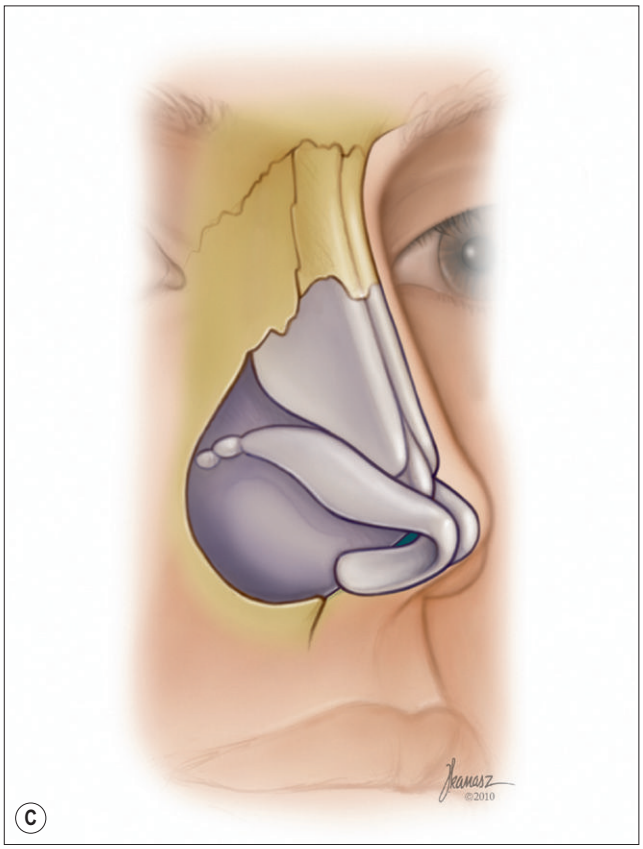


Figure 3.29 Illustration of removal of an anterior-based wedge of caudal septum to rotate the tip cephalically (A, B, C).

Figure 3.30 A patient before (A) and after (B) cephalic rotation of the tip using a wedge resection.

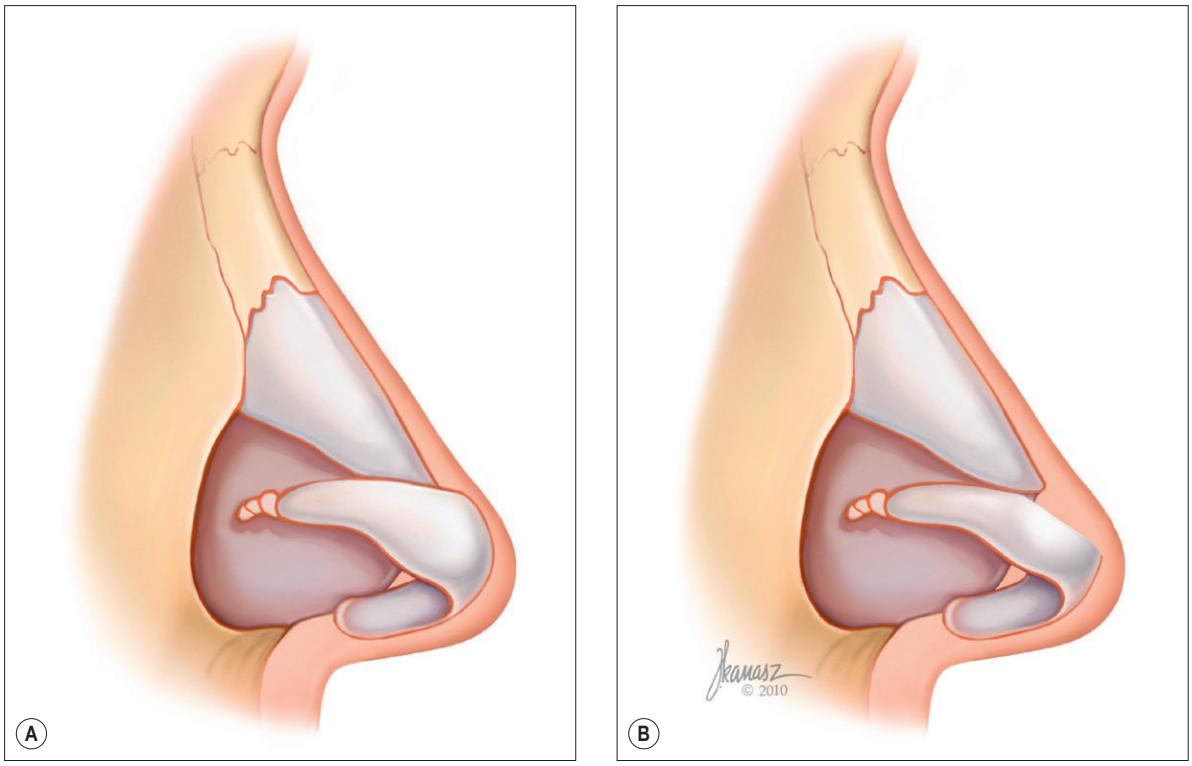


Figure 3.31 Illustration demonstrating that removal of the cephalic margin of the lower lateral cartilages will result in cephalic rotation of the tip.

Figure 3.32 Patient demonstrating the effects of footplate approximation and placement of a columella strut on tip rotation.

Augmentation and Reduction of Nasal Spine

A nasal spine graft results in a shorter upper lip, an increase in tip projection, and widening of the nasolabial angle (Figure 3.33; Animation 3.17). Reduction of the nasal spine will result in a longer appearance of the upper lip, narrowing of the nasolabial angle, and reduction in tip projection (Figures 3.27 and 3.34).

Animation 3.17 •

Footplates of the Medial Crura

The footplates support the nasal tip and control the width of the columella and shape of the nostrils. Approximation of the footplates will result in augmentation of the tip projection, narrowing of the columella base, cephalic

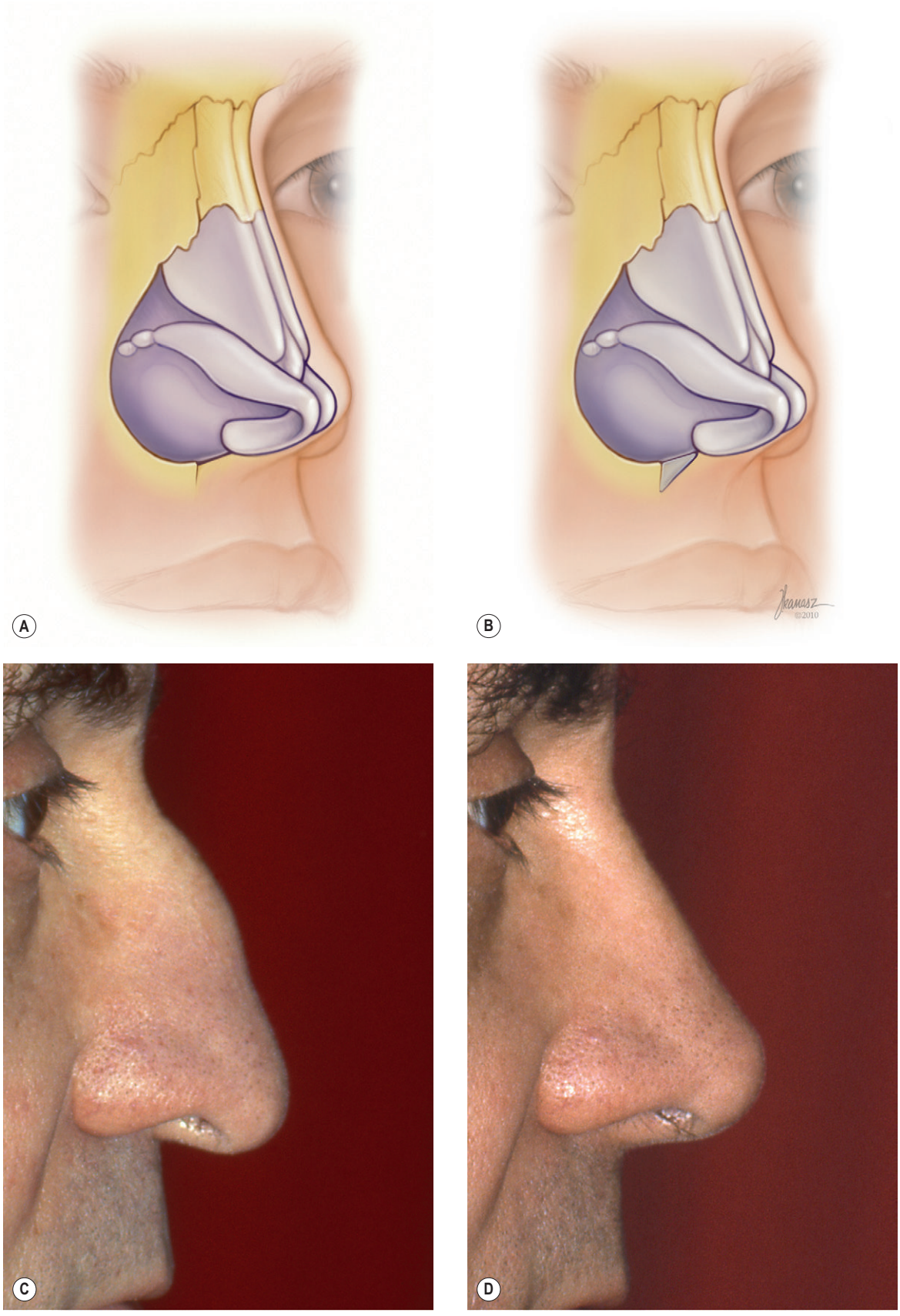


Figure 3.33 An illustration of the effects of augmentation of the nasal spine (A, B). A patient demonstrating the changes related to the augmentation of the nasal spine which includes a shorter appearing upper lip, increase in tip projection and a wider nasolabial angle (C, D).

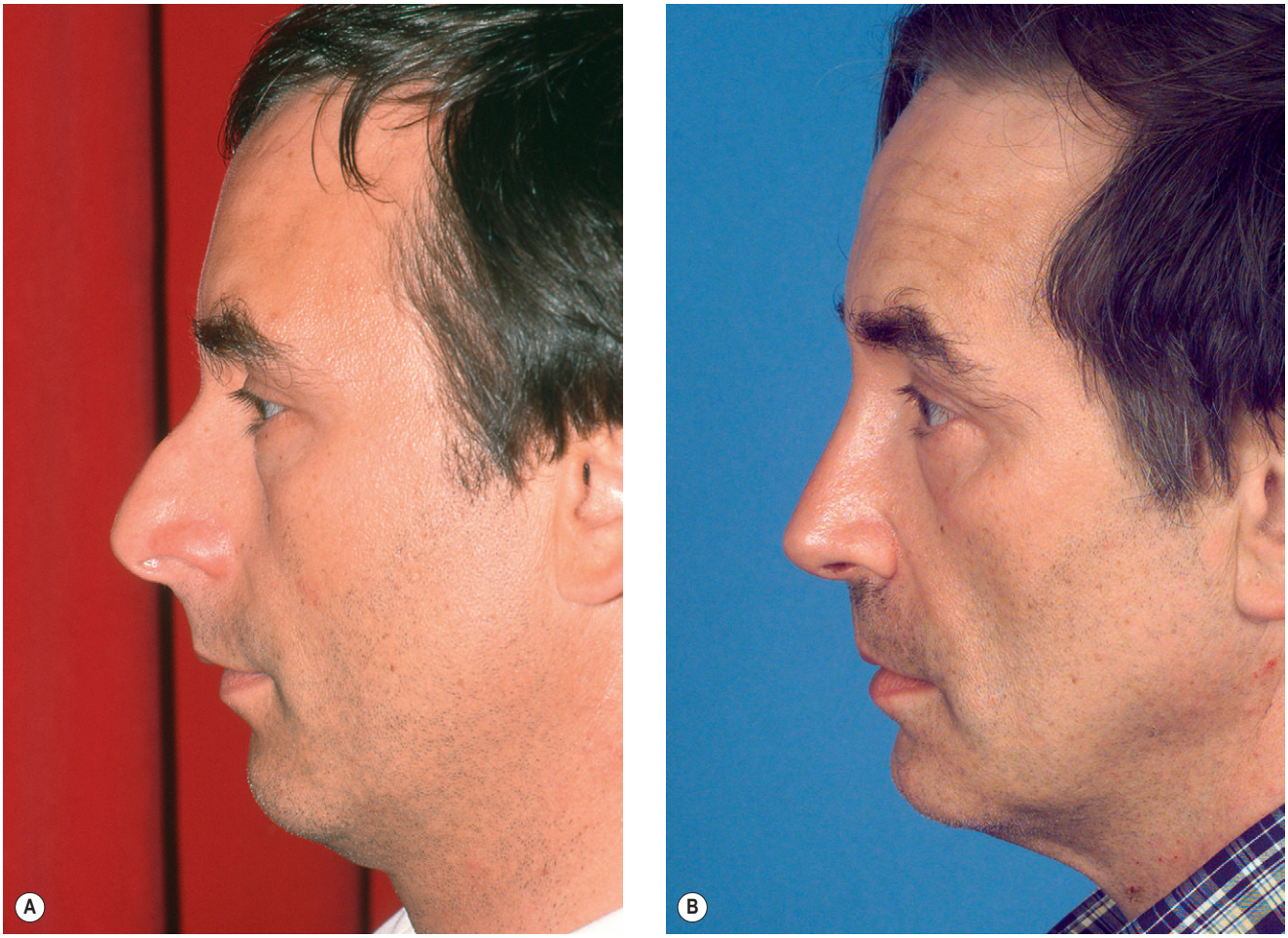


Figure 3.34 Patient before (A) and 10 years after (B) reduction of the nasal spine. This lengthens the upper lip, reduces the tip projection, and narrows the nasolabial angle.

rotation of the tip, and caudal advancement of the subnasale (Figure 3.35; Animation 3.18a & 3.18b). If it is imperative to avoid advancement of the subnasale, one can resect the lateral portion of the footplates and the soft tissues in between to eliminate the potential for excessive fullness at the base of the columella. Following longstanding caudal septal deviation, the footplate can be distorted, which will look asymmetrical even after repositioning of the septum. This may require medial repositioning of the footplate in addition to repositioning the anterocaudal septum to restore symmetry to the columella base (Figure 3.36).

Animation 3.18 •

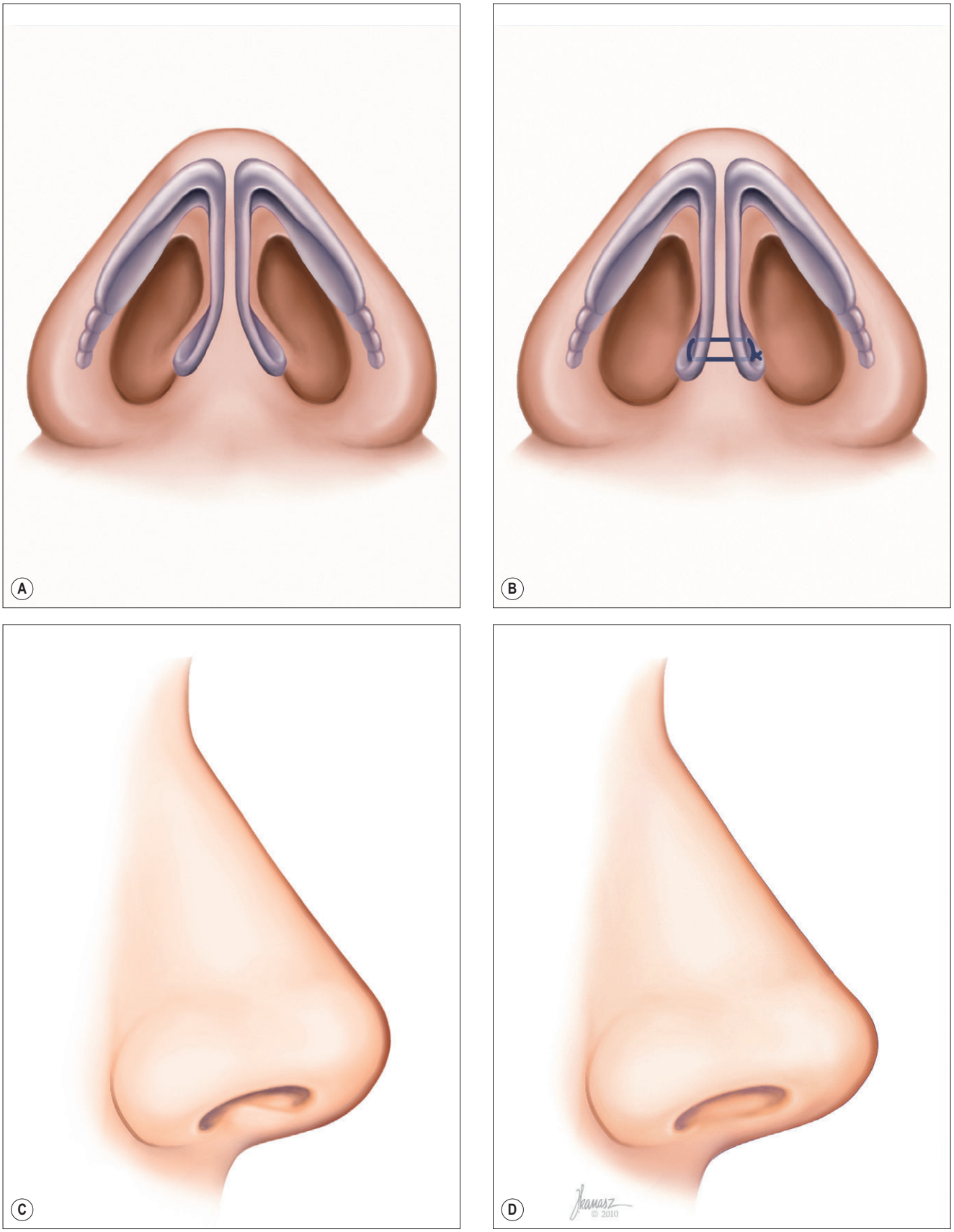


Figure 3.35 Illustration of approximation of the footplates which can result in augmentation of tip projection, narrowing of the columella base, and caudal advancement of the subnasale.

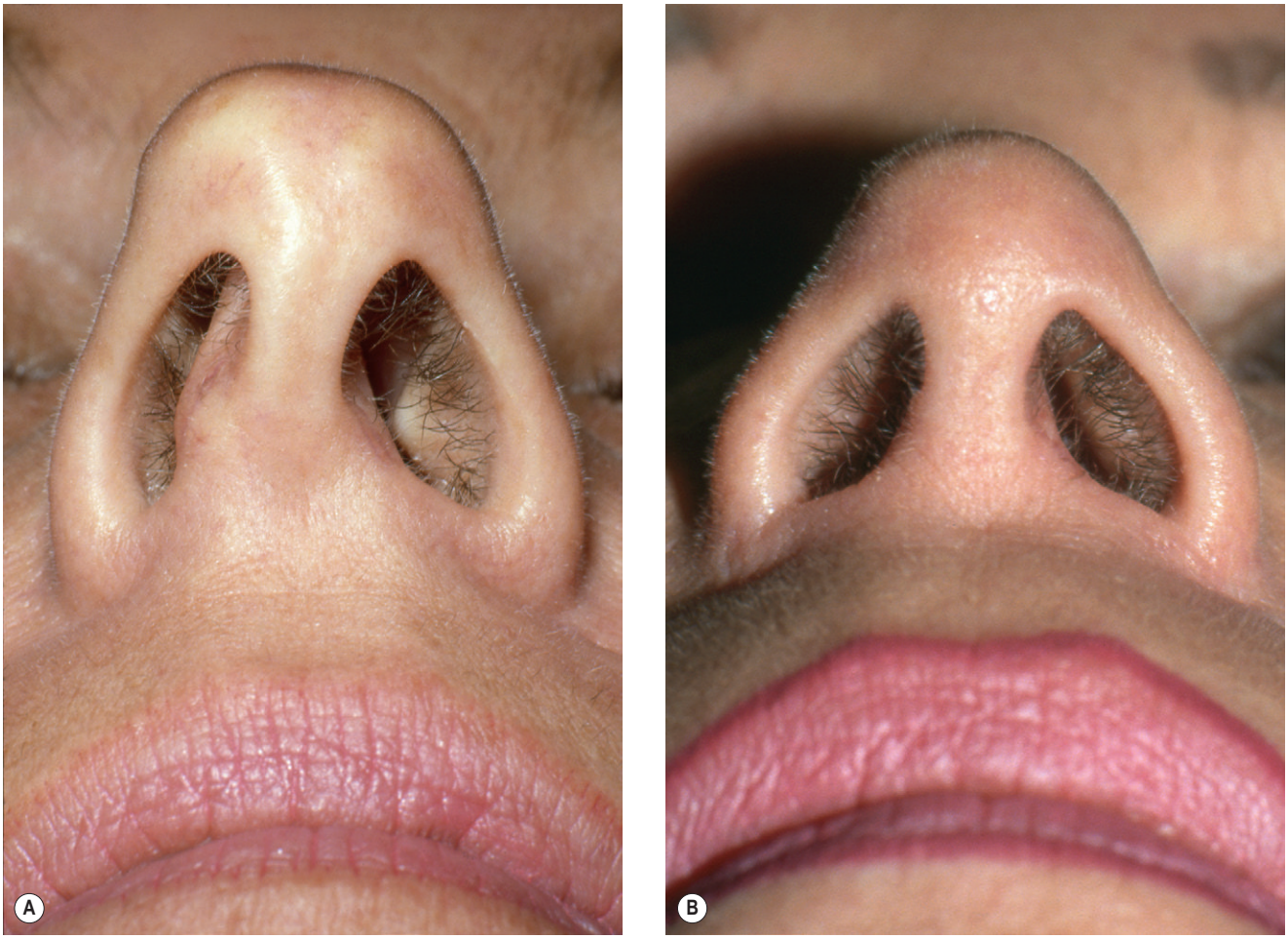


Figure 3.36 (A) Basal view of a nose with longstanding septal deviation influencing the footplate. (B) Following repositioning of the caudal septum and the footplate.

Reduction of tip projection can result in some other dynamic changes. These include widening of the alar base and caudal bowing of the columella (Figure 3.37; Animation 19).

Animation 3.19 •

Narrowing the Alar Base

Narrowing the alar base will not only result in reduction of the nostril width, it will also transpose the alar rim caudally (Figure 3.38; Animation 3.20). If significant alar base narrowing takes place, it may result in slightly reduced tip projection.

Animation 3.20 •

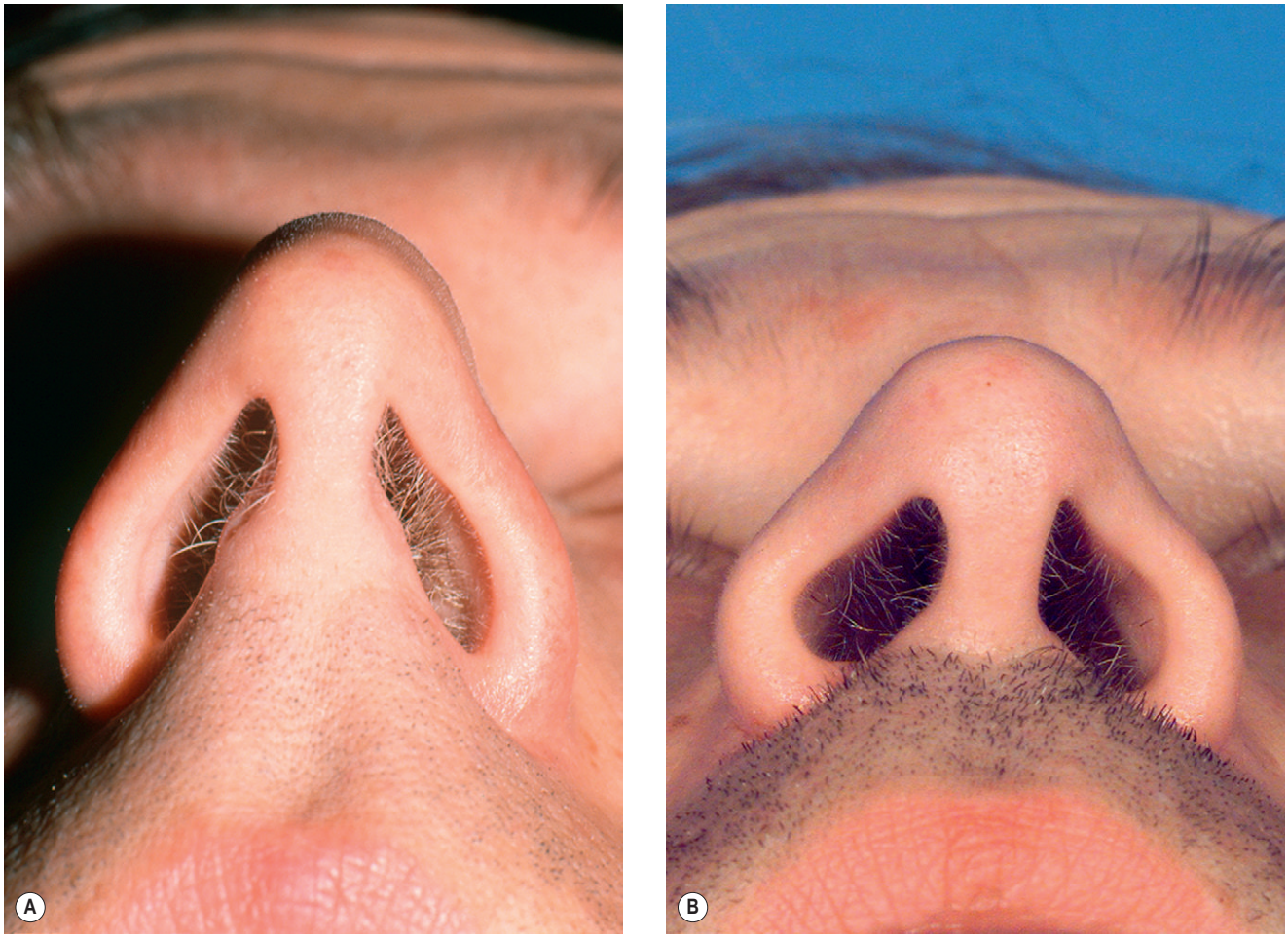


Figure 3.37 Basilar view before (A) and after (B) significant tip reduction, demonstrating widening of the alar base.

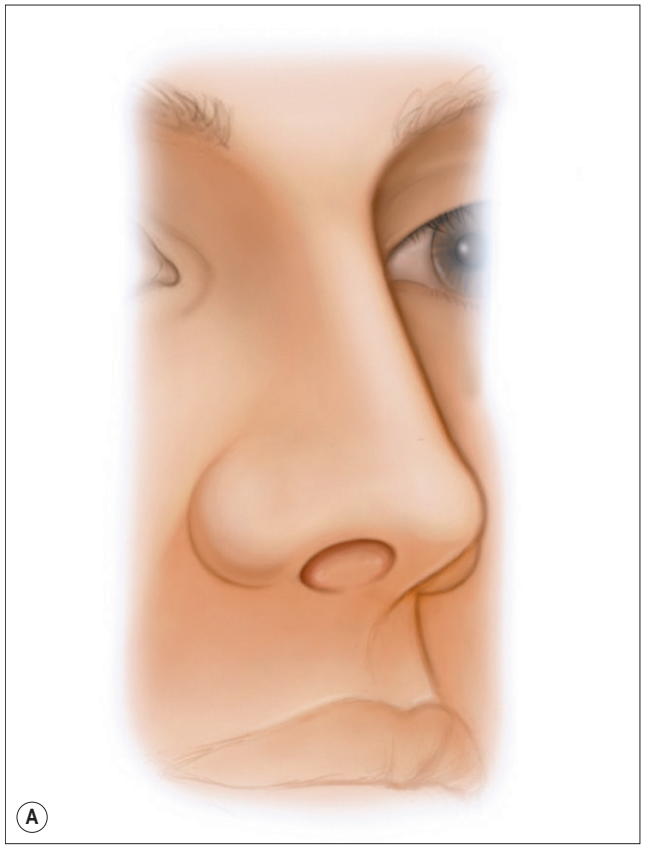
Placement of Alar Rim Graft

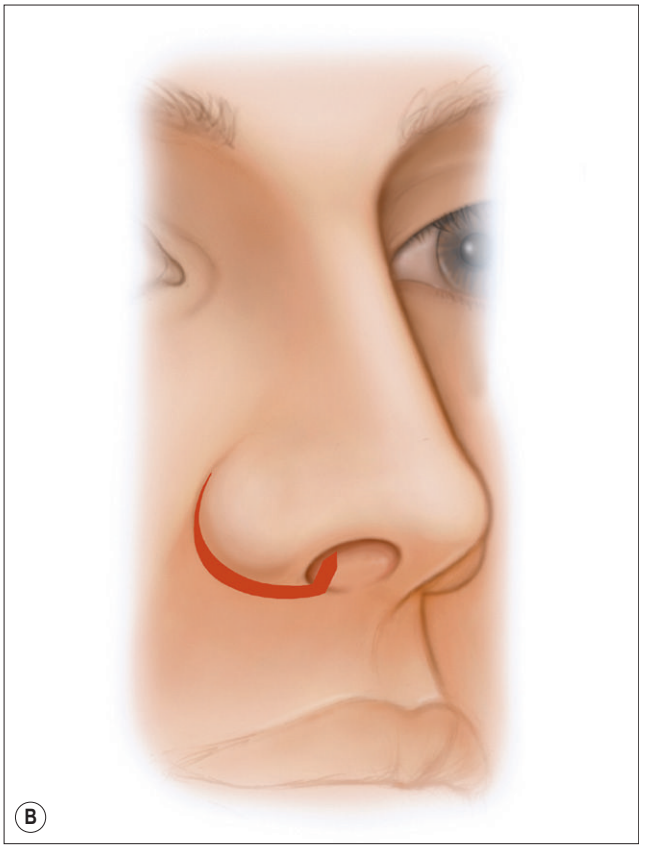
Animation 3.21 •

The effect of this graft is fascinating because, as it is inserted, it eliminates the alar concavity, repositions the alar rim caudally, increases the nostril length, and improves the function of the external valves (Figure 3.39; Animation 3.21).

Summary

Rhinoplasty dynamics are extremely complicated and perplexing in many respects. It is crucial to understand each effect clearly in order to produce consistent rhinoplasty outcomes. Additionally, there are many maneuvers that ostensibly produce the same outcome. However, each approach has subtle but unquestionable differences and recognition of these nuances will aid in proper application of the appropriate techniques and the achievement of optimal outcomes.





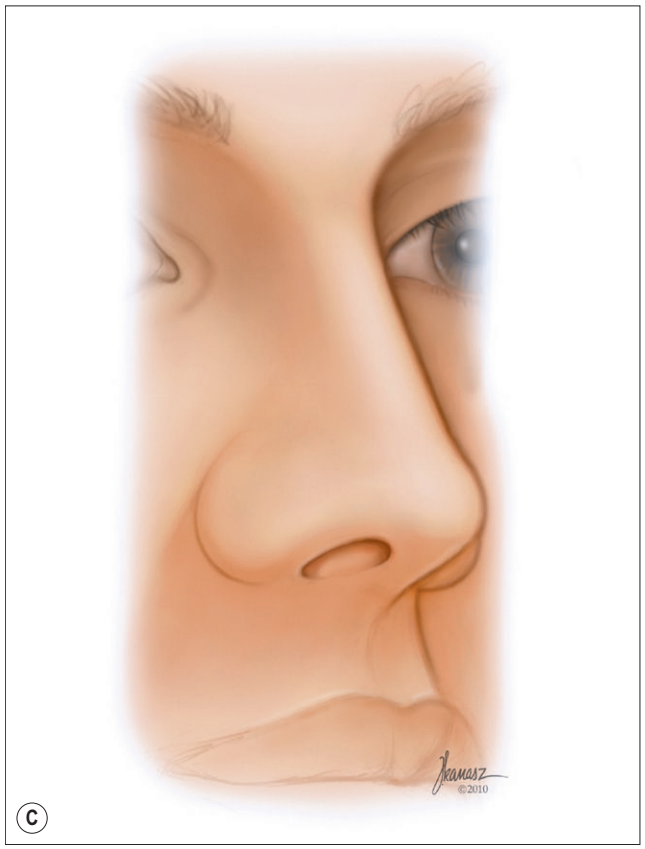


Figure 3.38 Artistic rendering demonstrating that as the alar base is narrowed, the alar rim migrates caudally and the projection may lessen if the alar base reduction is substantial.

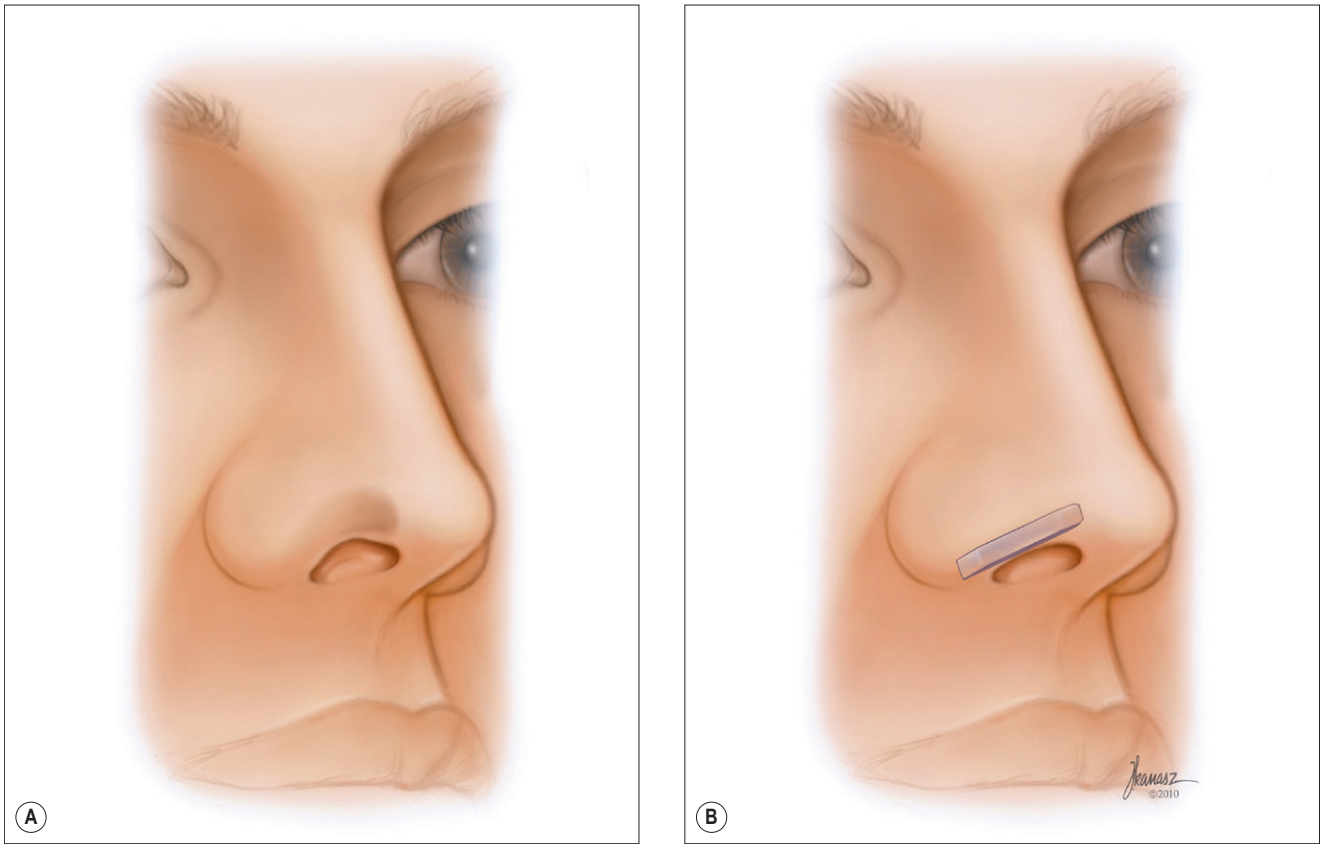


Figure 3.39 Artistic rendering illustrating that insertion of the alar rim graft results in correction of alar rim concavity and elongation of the nostril.

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Pearls

- The nose is initially injected with xylocaine containing 1:200 000 epinephrine and then 1:100 000 epinephrine after a few minutes to minimize the systemic reaction and maximize vasoconstriction.

- Preservation of the periosteum over the cephalic bony dorsum will protect the overlying muscles, provide a more natural shape to the nose and make minor residual nasal imperfections less discernible.
- When trimming the cephalic portion of the lower lateral cartilages, it is important to leave an equal amount of the cartilage behind rather than removing an equal amount since most lower lateral cartilages are asymmetric.
- If deepening the radix is part of the plan, it is often necessary to reduce the hump to facilitate deepening of the radix.
- The dorsal hump is removed using a combination of a bi-directional rasp for the bony hump and a knife for the cartilaginous hump after separation of the upper lateral cartilages.
- Before separation of the upper lateral cartilages, the soft tissue overlying the anterocaudal septum is removed.
- The sharp end of the septal elevator is used to separate the mucoperichondrium over the overlying dorsum to keep it intact.
- The upper lateral cartilages are separated from the dorsum if there is asymmetry or a large enough dorsal hump removal which can result in an open dorsal roof.
- A septoplasty is carried out using the anterior approach or an L-shape (Killian) incision.
- A septoplasty is performed leaving an L-shaped frame, at least 15 mm wide anteriorly and 10 mm wide caudally.
- Septal mucoperichondrial tears that are unilateral or bilateral, but not apposing, do not require any treatment.
- For opposing perforation of the septum, replacement of the septal cartilage or vomer bone will be sufficient without an attempt to repair to the laceration.
- Doyle or simple stents should be used after this type of septal perforation and left in place for at least a week.
- On patients with a longstanding deviation of the septum, the opposite inferior turbinate and occasionally the middle turbinates will become enlarged. This is usually ipsilateral to the external deviation of the nose.
- Only the hypertrophic portion of the inferior turbinate is removed with a pair of turbinate scissors, leaving behind an evenly shaped, normal sized turbinate. The raw surface of the turbinate is gently cauterized using suction cautery.
- A medial osteotomy is done using a 4 mm or 6 mm osteotome, complemented with a 2 mm percutaneous anteroposterior osteotomy and a lateral low-to-low osteotomy using a guarded osteotome.
- A wedge of bone is removed medially only if the nasal bones are too far apart.

- It is important to trim the upper lateral cartilages only after the septum and nasal bones have been repositioned, especially when there is an external nasal deviation.
- Spreader grafts are commonly used when a large dorsal hump is removed causing an open roof, or when there is a preexisting mid-vault narrowing and internal valve collapse.
- The upper lateral cartilages are approximated to the septum and spreader grafts using 5–0 PDS to avoid sinking posteriorly.
- When the anterior septum is deviated caudally, a septal rotation suture is used.
- A columella strut will be placed to elongate the columella and/or support the tip using septal cartilage, preferably, which is 3 mm wide with a variable length depending on the intended aesthetic goals.
- The tip cephalic rotation is achieved by removal of a triangular piece of caudal septum based anteriorly, a proportional amount of nasal lining and a tip rotation suture.
- The footplates are trimmed, if the subnasale is in an optimal position, or dissected and approximated (if the subnasale is retracted) using 5–0 PDS suture.
- If the domal arches are too wide, a transdomal suture is used.
- If the domal arches are ideally shaped but too far apart, then an interdomal or medial genu suture is used.
- If the domal arches are too close or are asymmetric, a subdomal graft is placed using a block of 1.5 mm × 1.5 mm cartilage approximately 10 mm long.
- If the infratip lobule is deficient causing an underprojected tip, a tip graft is applied.
- For patients who lack projection and in whom the infratip lobule does not extend caudally, a shield graft will be utilized.
- On patients who possess thick skin, a supratip stitch is placed.
- The columella incision is repaired using 6–0 fast absorbable catgut.
- A septal cartilage graft measuring 13–15 mm long and 2–3 mm wide is crafted from the thinnest portion of the septum and placed in the pocket as close to the alar rim as possible through an incision in the rim area.
- The alar base is narrowed.
- A combination of SteriStrips, Aquaplast, and metal splint are utilized to confine the soft tissues, limit swelling and create a proper nose definition.
- Doyle stents are removed in 4–8 days.
- The splint is kept in place for 7–8 days and removed after removal of the Doyle stents.
- Patients are instructed to avoid strenuous activities for 3 weeks and use of glasses for 5 weeks.

- Patients who do not have a history of acne will receive 10 mg of dexamethazone during surgery and a Medrol Dose Pack postoperatively.
- On patients who have supratip swelling, the nose is taped in the evening and through the night for 6 weeks.

The ultimate goal of any rhinoplasty is to have a pleasing nose that is harmonious with the rest of the face. Thus, a circumspect assessment of the entire face and analysis of the life-size photographs[1] is crucial because imperfections of other parts of the face that have been missed can detract tremendously from a nose that would otherwise have an ideal configuration. It is the congruity of the nose with other facial structures that, regardless of the magnitude of the change in the nose, avoids the appearance of 'surgical nose'. The other cardinal rule in achieving a desirable rhinoplasty outcome is to create an optimal balance between different segments of the nose itself. Each rhinoplasty step has to be logical and purposeful and must incorporate a full understanding of the dynamic changes that will ensue.

Operative Technique

The life-size photographs that have been analyzed using the soft tissue cephalometric principles described in Chapter 2 are hung from an IV pole next to the patient to be referred to during the surgery.[1] The procedure is performed almost exclusively under general anesthesia in the author's practice, unless a minor revision is planned. The nasal hair is trimmed using a pair of curved iris scissors and a piece of 0.5 inch (13 mm) adhesive tape wrapped around the end of a Q-tip is used to remove any hair particles (Video 4.1). The internal nose is cleansed and the face is prepped with Betadine solution and washed with saline solution.

Video 4.1 •

Vasoconstriction

If a turbinectomy is part of the surgical plan, the turbinates are injected with xylocaine containing 1:200 000 epinephrine using a 35 gauge spinal needle (Video 4.2a). The nose is packed with gauze saturated in oxymetazoline hydrochloride or phenylephrine solution, the gauze being placed as far cephalically and posteriorly as possible to cause vasoconstriction in the areas that are hard to reach through injection (Video 4.2b). The nose injection is started from the radix (Video 4.2c). The soft tissues along the lateral and medial surface of the nasal bones are injected profusely. The base of the nose and the columella are injected next. The dorsal portion of the septum is injected on either side of the nasal roof as completely as possible. The lining on either side of the vomer bone is also injected along the floor of the nose as far posteriorly and caudally as possible to reduce bleeding during the septoplasty. After allowing a few minutes for the effect of the epinephrine, the injection is resumed, this time using 0.5% ropivacaine containing 1:100 000

Video 4.2a • 4.2b • 4.2c • 4.3

epinephrine (Video 4.3). This double injection will minimize the potential for a systemic reaction and provide several hours of anesthesia. Otherwise, injection of the solution containing 1:100 000 epinephrine as the initial step can often induce hypertension, tachycardia, and even arrhythmia. Inclusion of ropivacaine and epinephrine minimizes discomfort during the immediate postoperative period, reducing the need for analgesics.

Incision

The incision is marked in the narrowest portion of the columella while the domes are pulled anteriorly using a blunt double hook. Before the incision is made, the skin hook is released to ensure that the incision is not too close to the nostrils. After allowing time for vasoconstriction, a step incision is made in the mid-columella and is continued along the caudal margin of the medial and lateral crura of the lower lateral cartilages (LLC) (Figure 4.1; Animation 4.1; Video 4.4). This incision provides the least visible scar and the best alignment of the wound margin at the time of repair.

Animation 4.1 •

Video 4.4 •

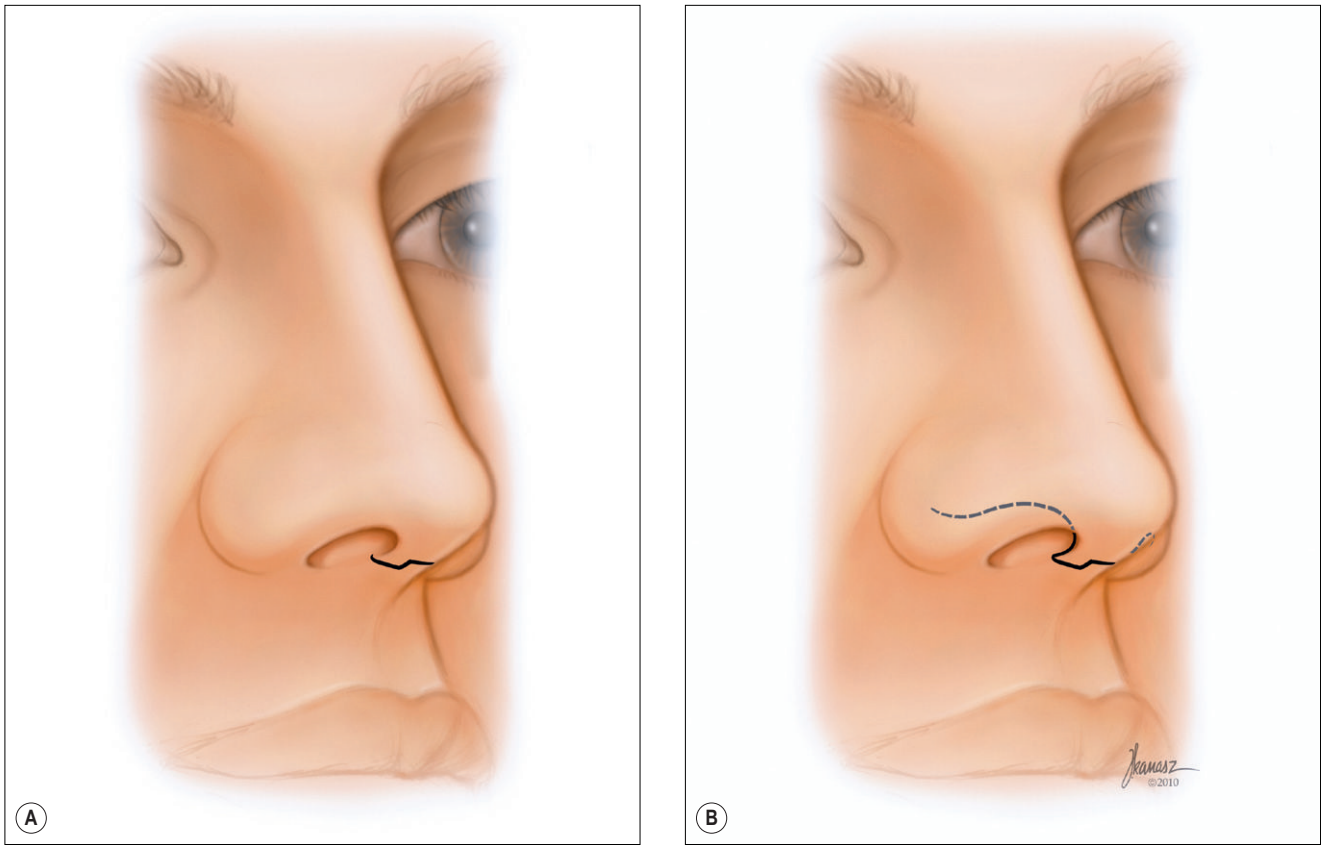


Figure 4.1 Illustration of the design of the step columellar incision.

Next, a single skin hook is placed under the right nostril to evert the alar margin while the operator's non-dominant index finger everts the ala, exposing the caudal margin of the lateral crus of the LLC. This incision is made on the left side in a similar fashion (Video 4.5). Using a pair of baby Metzenbaum scissors and a spread-and-cut technique, the soft tissues overlying the medial crura and the domes are separated from the underlying frame (Video 4.6). The dissection is continued cephalically to expose the anteromedial two-thirds of the lateral crura. In patients with thin skin, as much soft tissue as possible is raised with the skin flap side (Video 4.7). In patients with thick skin it is preferable to raise a healthy skin flap and maintain a robust circulation to it, leaving some of the fibrofatty tissue attached to the lower lateral cartilages, and mostly between the domes, to be subsequently dissected and discarded. The dissection is continued along the dorsum using the Metzenbaum scissors until the nasal bones are reached. At this point, an Obwegeser periosteal elevator is used to elevate the periosteum from the dorsum, making every effort to maintain the dissection in the subperiosteal plane (Video 4.8). Preservation of the periosteum will protect the overlying muscles, provide a more natural shape to the nose, and make any minor residual nasal imperfections less discernible. Violation of the periosteum and thinning of the soft tissues may result in visibility of the minor dorsal flaws, potential dimpling of the nose skin on animation, and telangiectases, common displeasing sequelae seen in patients who have undergone multiple previous rhinoplasties.

Video 4.5 • 4.6 • 4.7 • 4.8

The dorsum is now packed with gauze saturated with 1:50 000 epinephrine. A few minutes are allowed for the effect of the epinephrine to take place and the packing is removed.

Assessment of the Bleeding

At this point, nose bleeding is carefully evaluated. If it is deemed excessive, the blood pressure is measured by the anesthesiologist. If the systolic pressure is higher than 120 mmHg, it is reduced to this level by the anesthesiologist. In the absence of hypertension, excessive bleeding is commonly the consequence of either von Willebrand's disease or consumption of aspirin or nonsteroidal anti-inflammatory drugs, either of which will often respond favorably to the infusion of 0.3 µg/kg of body weight of DDAVP (desmopressin) dissolved in 50 ml injectable saline and infused over 30–45 minutes.[10]

Deepening the Radix

If the radix needs to be deepened after the periosteum is sufficiently elevated, a guarded burr will be used to achieve this (Figure 4.2; Video 4.9).[2] While the burr is running, it is gently moved from side to side, not cephalocaudal,

Video 4.9 •

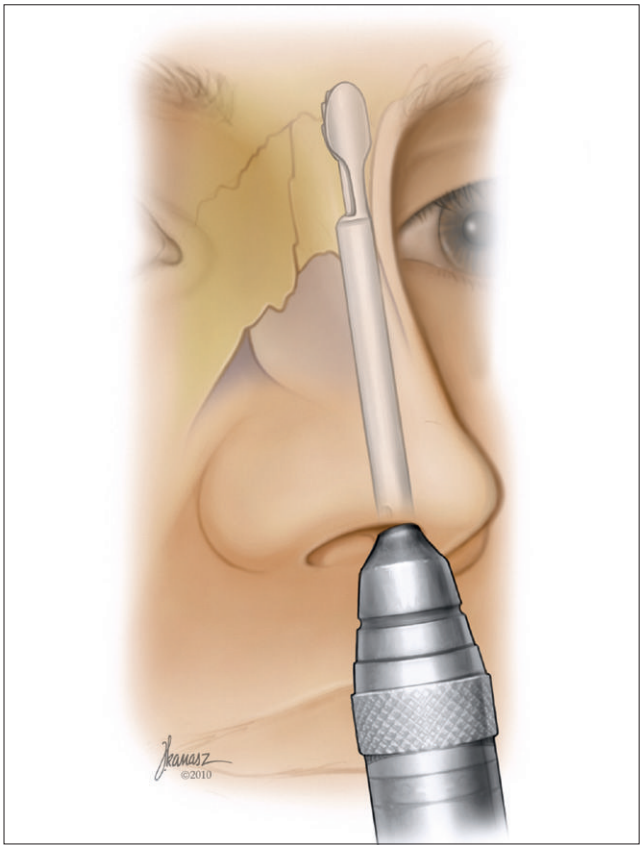
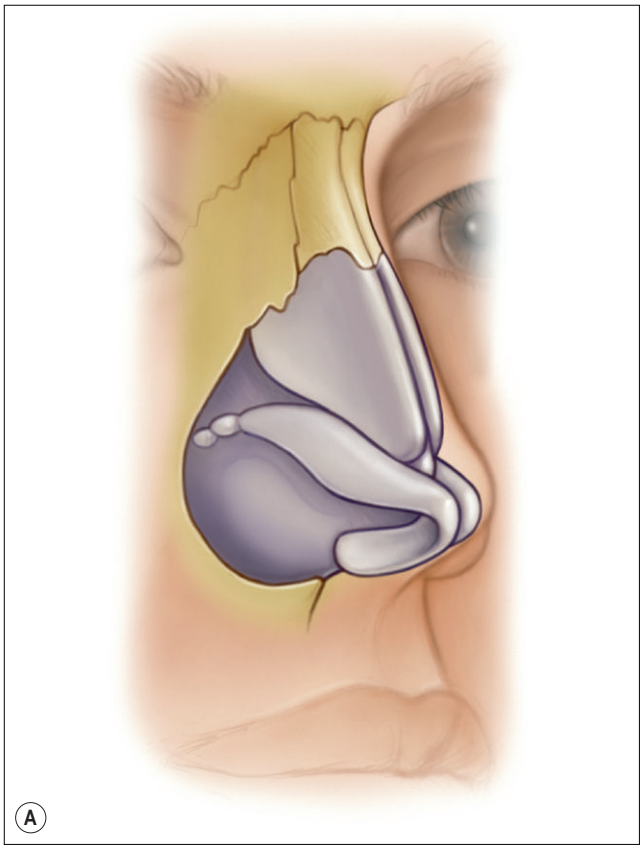


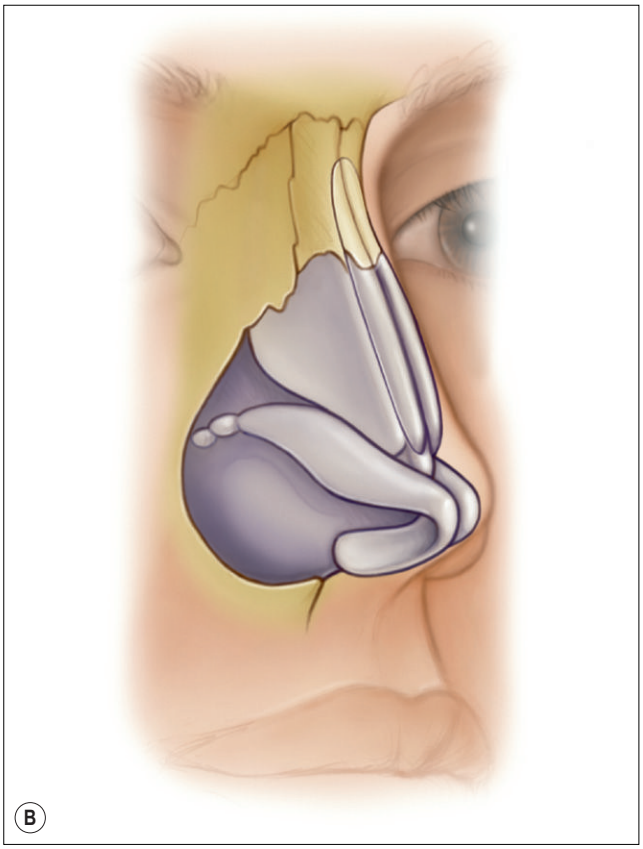
Figure 4.2 Artistic rendering demonstrating the use of a guarded burr is used to deepen the radix.

in order to avoid penetration of the frontal sinuses. The mid-portion of the burr is lined up with the upper tarsal crease. This is a very powerful tool and can produce sufficient deepening without too much effort. Additionally, the burr can generate significant heat, which can damage the soft tissues. It is therefore extremely important to lower the radix incrementally.

Removal of the Dorsal Hump

After the radix is deepened, the dorsal hump is eliminated. On patients with a large hump, it is often necessary to first remove a portion of the hump. Otherwise, one may face resistance in advancing the guarded burr in the desired site. In an ideal nasal frame, the nasion is deeper than the rest of the dorsum to accommodate the thicker soft tissues overlying this zone of the nose. The carbide push and pull rasp (Black & Black, Inc.) is then used to remove the bony hump. The rasp is activated in an oblique rather than a cephalocaudal direction, to minimize the potential for an inadvertent fracture of the septum. This is further minimized by placing the left index finger and thumb on either side of the nasal bones in such a way that, if the rasp slips, the digits will prevent it from damaging the septal frame (Figure 4.3;





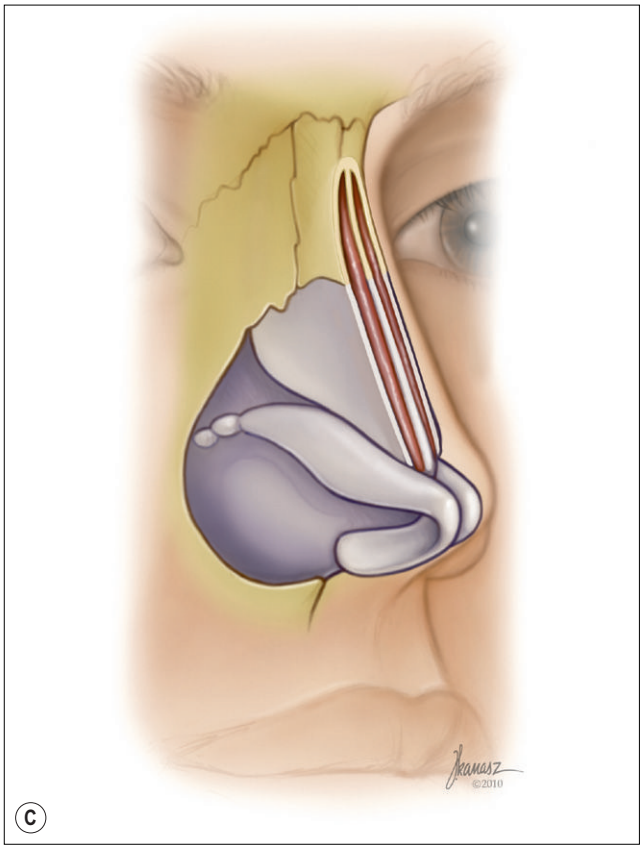


Figure 4.3 Artistic rendering of removal of the dorsal hump.

Animation 4.2 • Video 4.10a • 4.10b

Animation 4.2; Video 4.10a). The rasping is done incrementally until the bony dorsum appears optimal and an adequate step is created between the bony and the remaining cartilaginous dorsum, indicating the magnitude of reduction in the dorsal hump (Video 4.10b). The cartilaginous dorsum is left alone at this point.

Removal of the Cephalic Margin of the Lower Lateral Cartilages

Animation 4.3 • Video 4.11 •

The Lateral Crus Stabilizer Black & Black Surgical, Inc. is then used to harness the LLC. Maintaining about 4–5 mm width of LLC anteriorly and 6 mm or more posteriorly, the excess portion of the cartilage is removed (Figure 4.4; Animation 4.3; Video 4.11).[3] The incision in the cartilage is made with a no. 15 blade, and a pair of iris scissors is used to dissect and remove the excess cartilage. The mucoperichondrium is maintained intact, if possible. If the removed cartilage is thick and rigid enough it can be used as the alar rim graft. It is important to leave a symmetric amount of LLC in place since most of the time the LLCs are not symmetrical and, if one is focused on removing an equal amount of the LLCs, the remaining cartilages may not be symmetrical.

Exposure of the Anterocaudal Septal Angle

Video 4.12a • 4.12b • 4.13ai • 4.13aii

To keep the mucoperichondrium intact, the soft tissue overlying the caudal septal angle is removed to gain access to the caudal end of the upper lateral cartilages (ULCs) and the dorsum (Video 4.12a). This portion of the mucoperichondrium may act as an intrinsic spreader graft in patients who only possess a very small dorsal hump (1 mm or less). The ULCs are then separated from the dorsum, using a pair of Joseph's scissors, in most patients except for those who have a straight nose with minimal or no hump (Video 4.13ai). The cartilaginous hump is removed, but the upper lateral cartilages are not trimmed at this time (Video 4.13aii).

Septoplasty

Video 4.13bi • 4.13bii

If a septoplasty is intended, it is done through an anterior approach by elevation of a left-sided mucoperichondrial flap. Alternatively, a left-side Killian incision could be utilized. The mucoperichondrium is dissected off the caudal septum if repositioning this part of the septum is necessary (Video 4.13bi). To begin elevation of the septal mucoperichondrium, the sharp end of the periosteal elevator is used for the dissection initially (Video 4.13bii). After entering the right plane, it is very easy to continue the dissection cephalically and posteriorly with the dull end of the septal elevator.

Separation of the medial crura can increase the septal exposure if an anterior approach is selected for the septoplasty, as long as it is part of the surgical

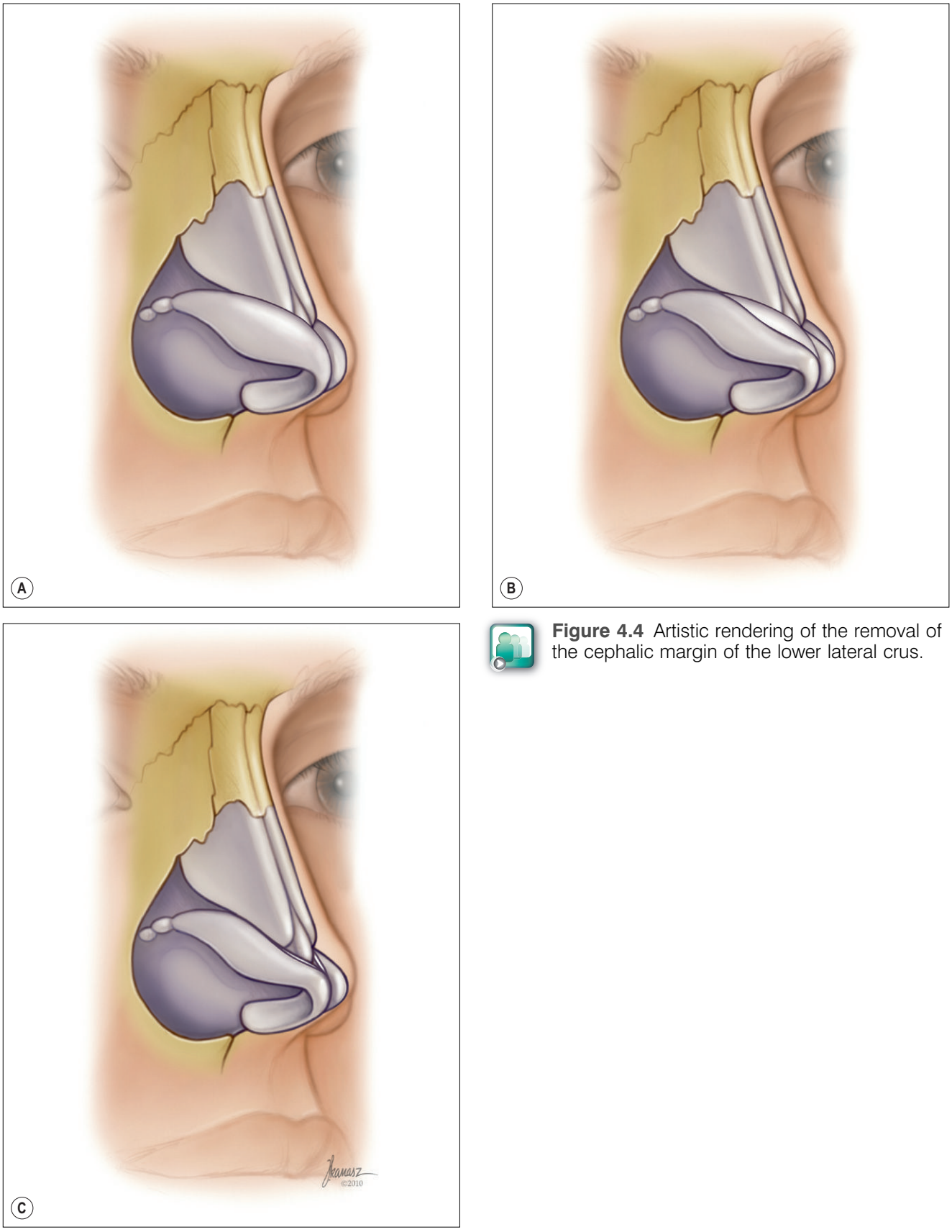


Figure 4.4 Artistic rendering of the removal of the cephalic margin of the lower lateral crus.

goals for other reasons. As the medial crura are separated, some soft tissues located in between them and the footplates are removed, including the depressor nasi septi muscle. This muscle pulls the tip caudally when the patient smiles, narrowing the columellolabial angle. Removal of the soft tissues between the medial crura will eliminate this pulling effect and enable later approximation of the footplates without protrusion of the subnasale.

The mucoperiosteum and mucoperichondrium can be readily separated from the septal frame posterocaudally. Conversely, the fibrous bands along the junction of the vomer bone and the quadrangle cartilage are firm anteriorly, making the dissection extremely tedious. Thus, it is safer and easier to conduct this part of the dissection in a posterior–anterior direction (Video 4.13biii). After the full extent of the mucoperichondrium is elevated on the left side, the sharp end of the septal elevator is used to incise the septal cartilage while leaving an L-shaped strut for the dorsal and columellar support, with at least 15 mm maintained anteriorly and 10 mm caudally (Video 4.13biv). In reality, only the portion of the septum that is deviated or that it is absolutely necessary to remove is resected to serve as the source of cartilage graft or to eliminate the deviation. The traditional recommendation to leave a 10 mm frame may carry the risk of the dorsum sinking and resulting in a saddle-nose deformity. Often, this posterior shift is small and manifests itself as a small dorsal hump that was not present intraoperatively or even during the immediate postoperative period.

Video 4.13biii • 4.13biv

After marking the L-shaped incision, the dull end of the elevator will be used to enter between the mucoperichondrium and the cartilage on the right side. The dissection continues posterocaudally until the full extent of this part of the septal frame is exposed. Commonly, the caudal portion of the cartilage is found dislodged to one side of the maxillary crest of the vomer bone. It is crucial to free this overlapping portion of the quadrangle cartilage from the maxillary crest using the sharp end of the elevator diligently to avoid septal perforation (Video 4.13bv). Here as well, it is often easier to start the dissection posteriorly and progress anteriorly. The posterior portion of the cartilage is gently separated from the perpendicular plate using the sharp end of the elevator and this segment of the quadrangular cartilage is removed (Video 4.13bvi).

Video 4.13bv • 4.13bvi

If a small perforation in the mucoperichondrium on one side of the septum is noted, it is not necessary, nor is it prudent to repair it. Even perforations that are bilateral, but are not opposing each other, do not need to be repaired. It is the opposing perforations that may require replacement of a straight segment of the septal cartilage or the removed portion of the perpendicular plate to provide a scaffold for the mucosa to heal over and to prevent free communication between the two nasal cavities. It is not necessary to repair the perforations by suturing; however, bilateral Doyle or simple splints made by Supramid will be applied and kept in place for 10 days to 3 weeks, depending on the size of the perforation.

Commonly, the maxillary crest of the vomer bone or the entire vomer bone is also deviated and there is a spur on one side of the septum. It is essential to remove the deviated portion of vomer bone using a rongeur (Video 4.13bvii). Often, the anterior nasal spine (ANS) is deviated, which can then be repositioned with an osteotomy. If the ANS is excessively protruding, it can be reduced. It is also of cardinal importance to remove the excessive and overlapping portion of the posterocaudal septum, which is invariably dislodged to one side of the septum to facilitate a swinging door type mechanism (Video 4.13c). A 5-0 PDS suture is then used to fix the septal cartilage in its new position (Video 4.13d). Commonly, a single suture attaching the cartilage to the periosteum of the ANS will suffice. One has to make sure that the ANS is in a proper position before fixing the cartilage to it. Otherwise, one will be repositioning the cartilage on an abnormal foundation that will invariably result in failure to correct deviation of the anterocaudal septum and the columella.

Video 4.13bvii • 4.13c • 4.13d

Turbinectomy

On patients with a long-standing deviation of the septum, the opposite inferior turbinate and sometimes the middle turbinate will become enlarged. It is therefore essential to remove the excessive portion of the turbinates. Only the hypertrophic portion of the inferior turbinates is removed with a pair of turbinate scissors, leaving behind an evenly shaped, normal-sized turbinate (Figure 4.5; Video 4.14a). If only the anterior or the posterior portion of the turbinate is removed, the remaining segment of the turbinate will hypertrophy and possibly protrude into the airway at a later time. After removal of the excessive portion of the turbinate, the raw surface of the turbinate is gently cauterized using suction cautery (Video 4.14b). The inferior turbinates can be reduced using coblation with the setting of 10 seconds duration, 6 mJ coblation, and 2 coagulation. However, the author found this technique less predictable and more costly.

Video 4.14a • 4.14b

Following completion of septoplasty, the Doyle stents are inserted and fixed to the membranous septum using through and through 4-0 polypropylene sutures. It is advisable to insert these stents before an osteotomy to ensure that the nasal bones are not displaced medially (Video 4.15). The end of the suture is left long and is placed in the tube portion of the stents to avoid irritation of the nasal lining and also to make it easy to find.

Video 4.15 •

Osteotomy

A medial osteotomy is performed using a 4 mm or 6 mm osteotome. The osteotome is first placed medial to the nasal bones and then advanced cephalically with gentle tamping using a mallet. A wedge of bone is removed medially to allow repositioning of the nasal bones, but only if the nasal bones are too far apart from the septum (Figure 4.6; Video 4.16; Animation 4.4). An

Animation 4.4 •

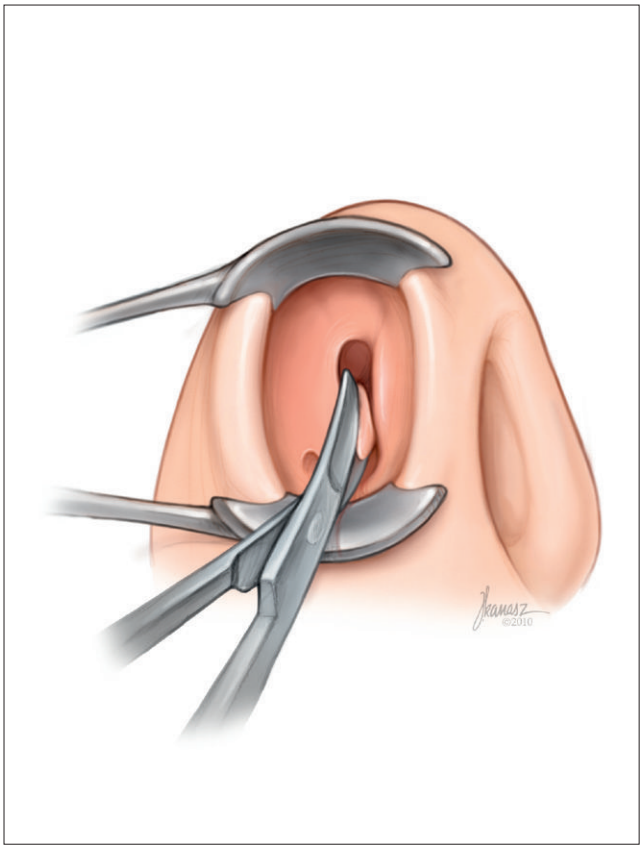


Figure 4.5 An illustration demonstrating removal of the excess portion of the turbinate evenly using a pair of turbinate scissors.

Video 4.16 • 4.17

anteroposterior osteotomy is then carried out percutaneously using a 2 mm osteotome. To do this properly, the nasal bones are palpated to identify their diverging point to begin the osteotomy (Figure 4.6; Video 4.16). That way, one is not depending on an anatomical reference, which may or may not have any relevance to the point of divergence of the nasal bone, to begin the osteotomy. If a fixed anatomical point is used as a guide for the site of the percutaneous osteotomy, it may be too cephalad, which makes it more difficult, or too caudal, which increases the incidence of irregularities along the dorsum. The osteotome is inserted through a single puncture in the skin and muscles fairly anteriorly to avoid injury to the angular artery (Figure 4.7; Video 4.17). It is then directed posteriorly and cephalically by sliding it under the periosteum. Several interrupted punctures are made in a linear fashion.

Animation 4.5 •

Video 4.18ai • 4.18aii

An incision is then made in the vestibular lining close to the piriformis aperture using a 15 blade. A Joseph's periosteal elevator is then used to elevate the periosteum. The periosteum is a great barrier and, if protected, it reduces periorbital ecchymosis by avoiding diffusion of blood into the vulnerable eyelid soft tissues (Video 4.18ai). A low-to-low osteotomy is carried out at the junction of the nose and face (Figure 4.8; Animation 4.5; Video 4.18aii). This osteotomy is placed posterior to the natural nasal bone suture line and

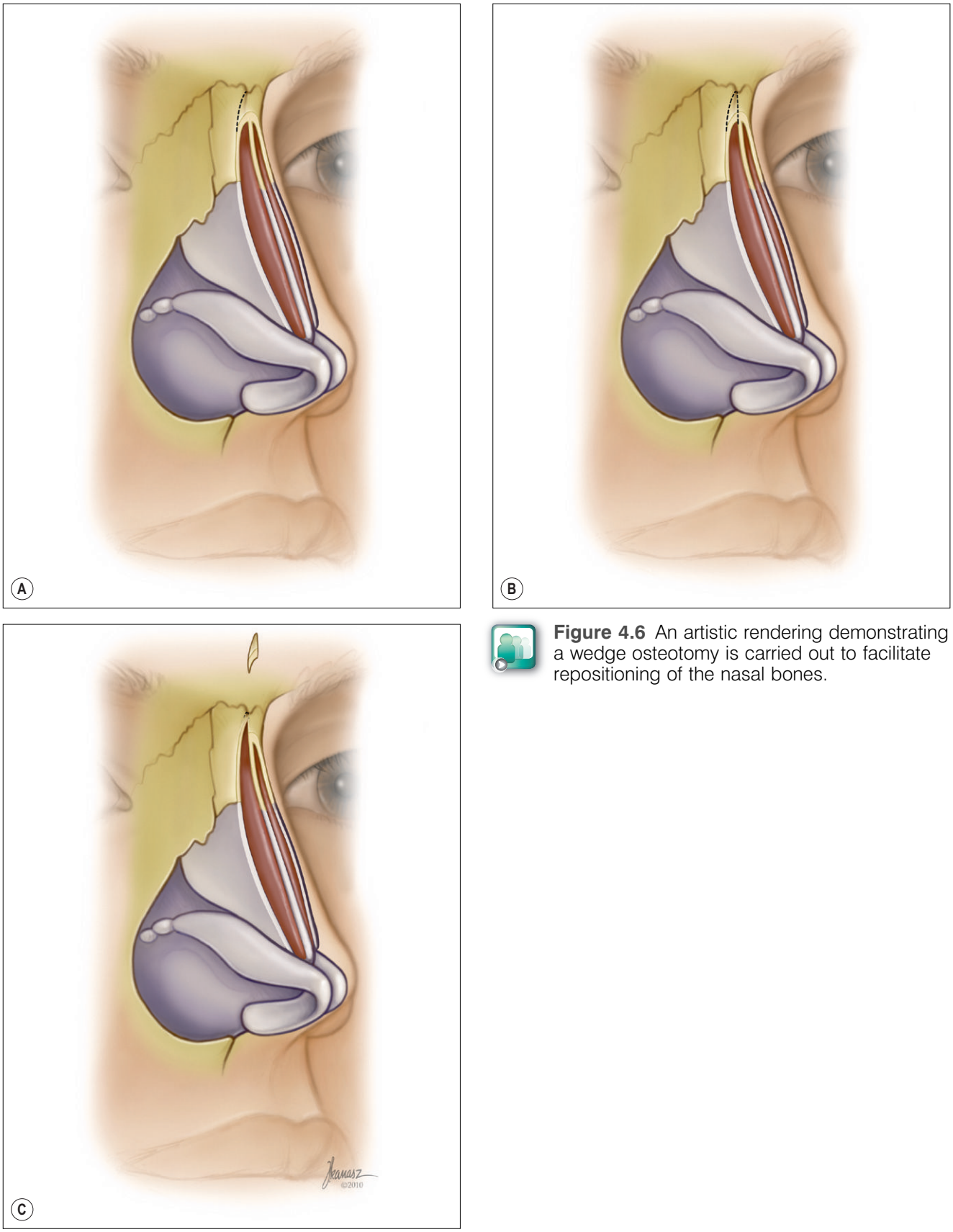


Figure 4.6 An artistic rendering demonstrating a wedge osteotomy is carried out to facilitate repositioning of the nasal bones.

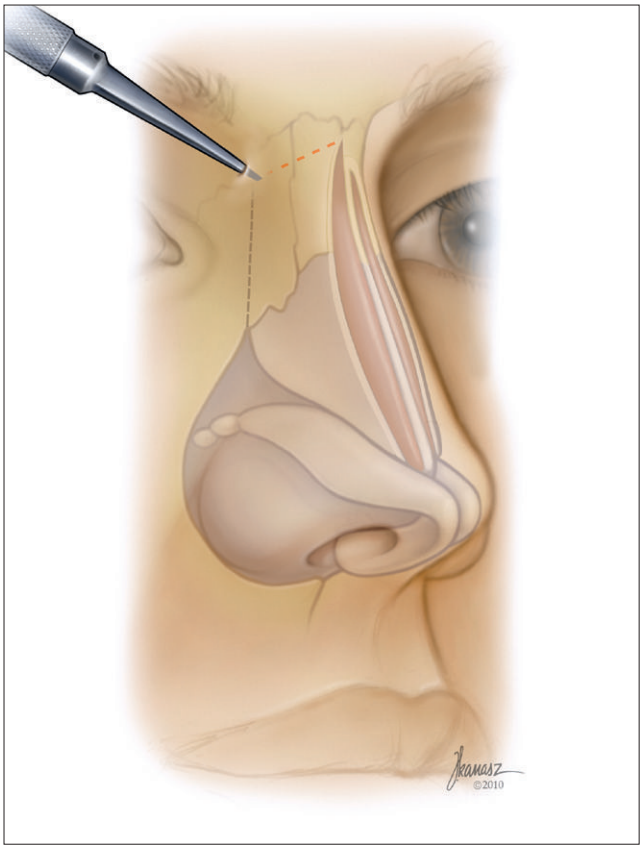


Figure 4.7 Illustration demonstrating the use of a 2 mm osteotome to complete the vertical osteotomy.

part of the osteotomy is in the frontal process of the maxilla to avoid a step deformity, a commonly seen imperfection in secondary rhinoplasty cases.

Trimming the Upper Lateral Cartilages

It is important to trim the upper lateral cartilages (ULC) only after the septum and the nasal bones have been repositioned, especially when there is a nasal deviation. Otherwise, one may find one ULC deficient and the other excessive when the deviated anterior dorsum is straightened (Video 4.18b).

Video 4.18b •

Planning the Cartilage Grafts

The cartilage grafts are designed next. It is crucial to economize the removed septal cartilage and design the pieces that will serve the plans more suitably. Harvesting a straight piece of cartilage, if one is needed, for the dorsum and the columella strut would be the top priority. The spreader grafts are then prepared. A tip graft as a subdomal, onlay, or shield graft would be the next priority. Alar rim grafts are designed next. The final priorities are the radix and the nasal spine grafts.

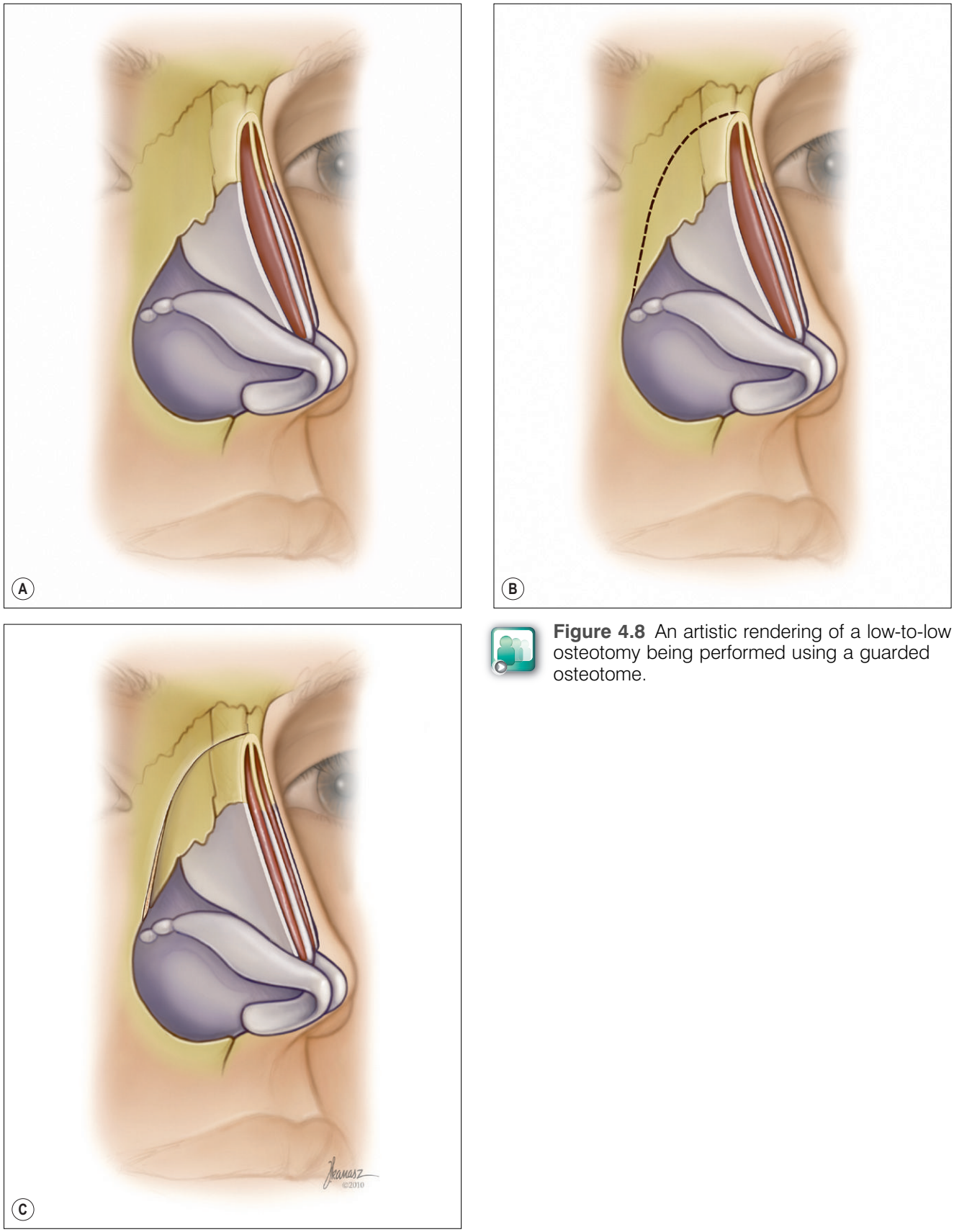


Figure 4.8 An artistic rendering of a low-to-low osteotomy being performed using a guarded osteotome.

Spreader Grafts

Most patients have a potential for a mid-vault collapse and medial shift of upper lateral cartilages causing the inverted V deformity following removal of the dorsal hump and an osteotomy, especially if a large hump is removed. These patients would benefit from spreader grafts. Whenever there is a question about whether the spreader graft should be used, one has to favor using it. One maneuver to confirm the usefulness of the spreader graft is compression of the mid-vault between the thumb and index finger for a few minutes after the completion of the osteotomy. When the dorsum is released, one should not detect a narrowing of the dorsal outline in the mid-vault area. Otherwise, spreader grafts will serve the patient. In rare incidences, it may be necessary to use the spreader graft on one side only to compensate for the anterior septal deviation. Two pieces of graft, usually 3 mm wide, one for each side, extending from a point about 1–2 mm cephalad to the caudal anterior end of the nasal bone to the caudal end of the lower lateral cartilage are prepared (Video 4.19a). The ends of the spreader graft are beveled to avoid a palpable or visible ridge. The spreader grafts are fixed to the septum using a double-armed 5-0 polyglactin stitch (Figure 4.9; Animation 4.6; Video 4.19b). After the needles have been passed through the cartilage, the necessary

Animation 4.6 •

Video 4.19a • 4.19b

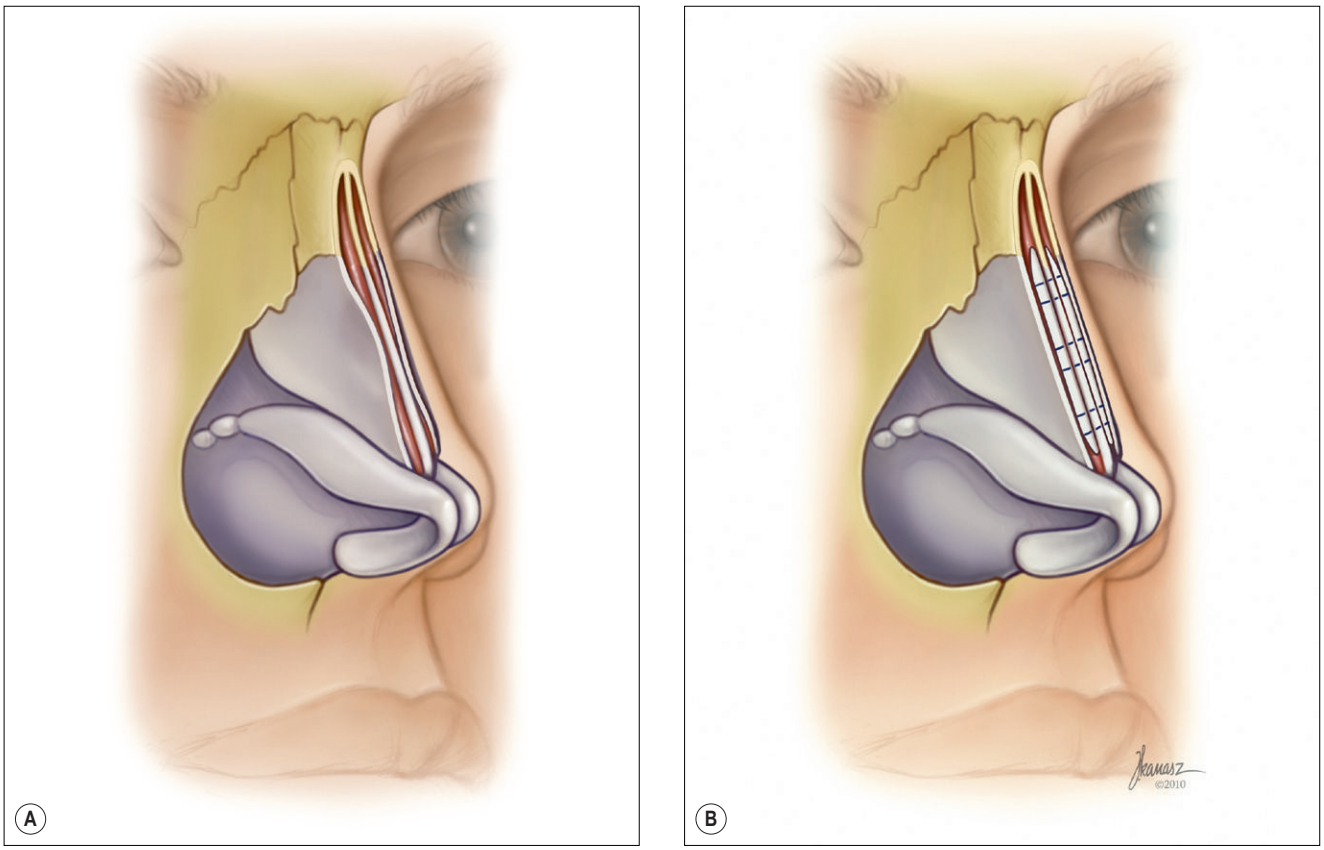


Figure 4.9 An illustration demonstrating spreader grafts that are placed and fixed in position with 5-0 polyglactin.

adjustments are made prior to pulling the sutures through. This ensures that the spreader grafts are precisely aligned with the dorsum before final fixation. Generally, two and sometimes three sutures are used to fix the graft and to avoid rotation or dislodgement.

Reattachment of the Upper Lateral Cartilage

One of the most crucial parts of this operation is to reattach the upper lateral cartilage to the septum and to create confluent dorsal lines. This is done using 5-0 polydioxanone. This suture also enforces fixation of the spreader grafts to the septum.

Septal Rotation Suture

If the septum is still deviated anterocaudally, a septal rotation suture is then placed. When the mattress suture is placed to approximate the upper lateral cartilages to the septum, it is passed more cephalically on the opposite side of the deviation (Figure 4.10; Animation 4.7; Video 4.20a). As the suture is tied, it will shift the septum to the midline.[4] It is often necessary to place a second suture to avoid bowing of the upper lateral cartilage. These mattress sutures are placed as anteriorly as possible to prevent narrowing of the internal valve.

Animation 4.7 •

Video 4.20a •

Columella Strut

The columella strut is harvested from the longest and strongest piece of septal or conchal cartilage (Video 4.20bi). If the medial crura have not been separated, a wide double hook is placed under the nostrils, the domes are pulled anteriorly and the medial crura are tattooed (Figure 4.11; Animation 4.8). Alternatively, the medial crura are separated and the soft tissues between the medial crura are removed (Video 4.20bii), the strut is placed in between the medial crura, the domes are pulled anteriorly and two 25 gauge needles are passed through the medial crura. The needle tips are saturated with brilliant green and are pulled through to tattoo across the medial crura and the columella strut (Video 4.20biii). Ideally, the most projected portion of the domes should extend 6–10 mm anterior to the caudal dorsum, depending on the thickness of the nasal skin. The thicker the skin, the more differential a level is needed to induce a supratip break. The columella strut can be prepared in varying lengths depending on the aesthetic goals. It is essential to insure that the domes and medial crura are aligned properly and the columella strut is positioned precisely and fixed to the medial crura guided by the tattoo marks. If the objective is to augment the tip projection, the strut should touch the ANS. Two 5-0 polydioxanone sutures are placed to fix the medial crura to the columella strut in order to avoid any rotation of the columella strut (Video 4.20biv). Widening of the columella is commonly observed in secondary rhinoplasty patients who have a columella strut placed. This can be avoided

Video 4.20bi • 4.20bii • 4.20biii • 4.20biv

Animation 4.8 •

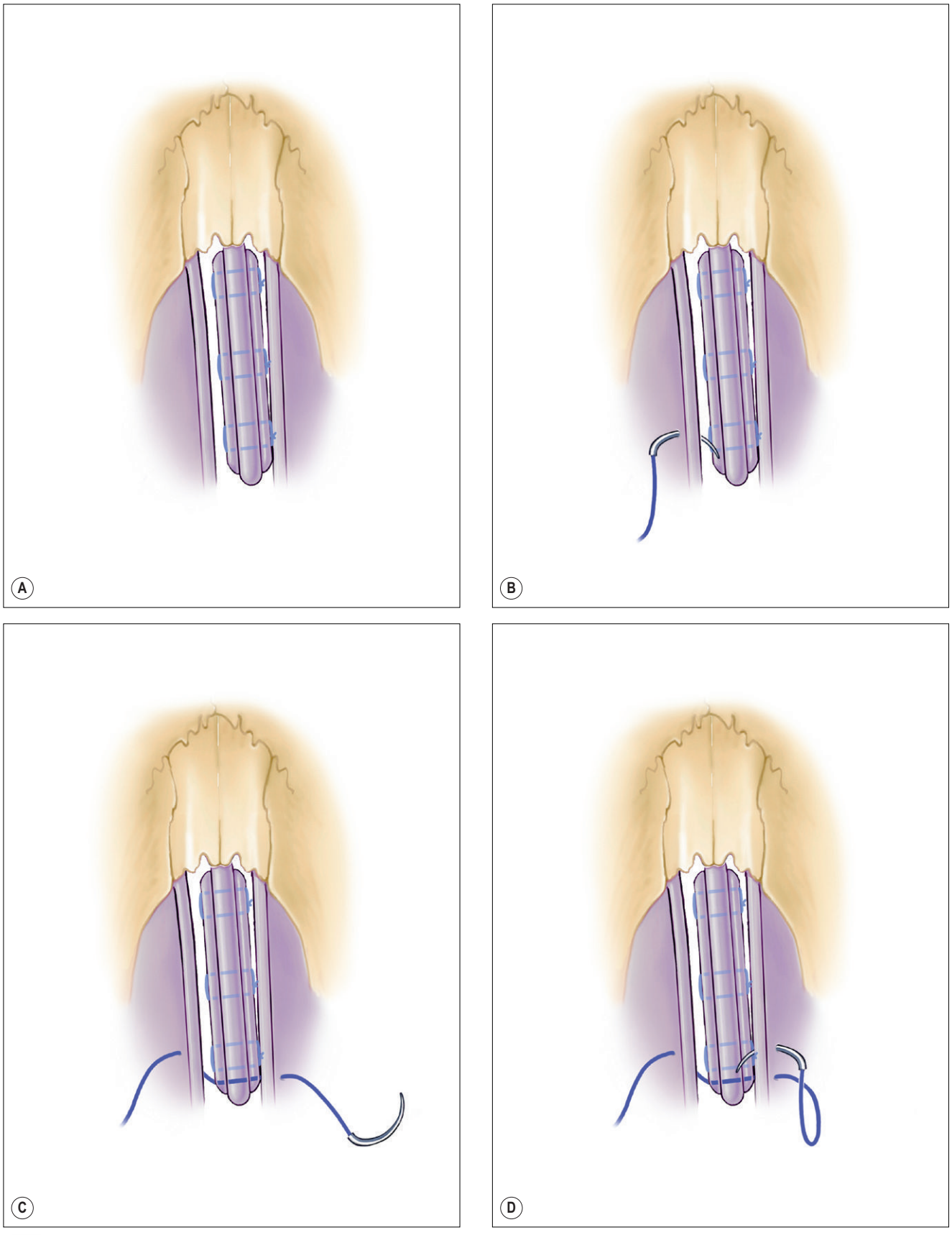
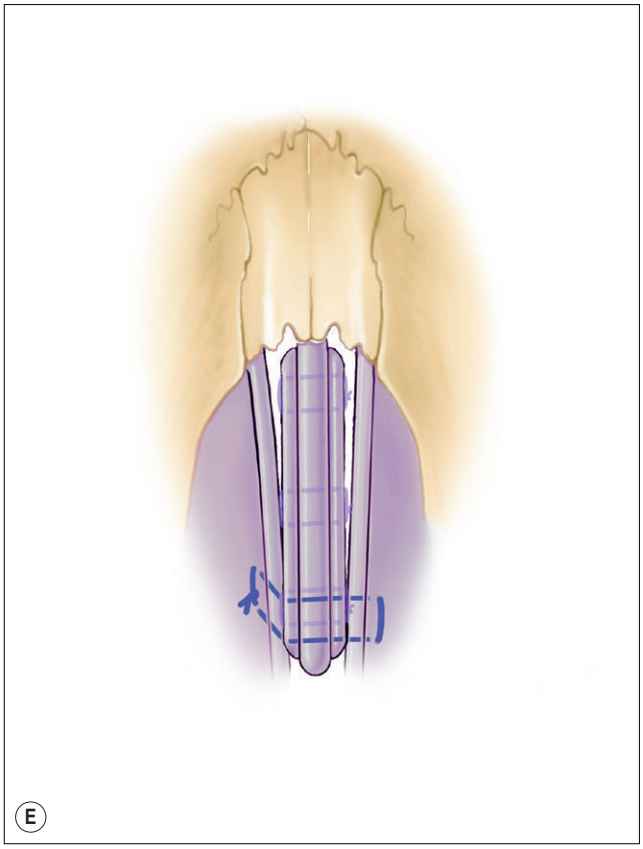


Figure 4.10 A rendering of placement of a septal rotation suture to correct the anterior deviation of the nose.



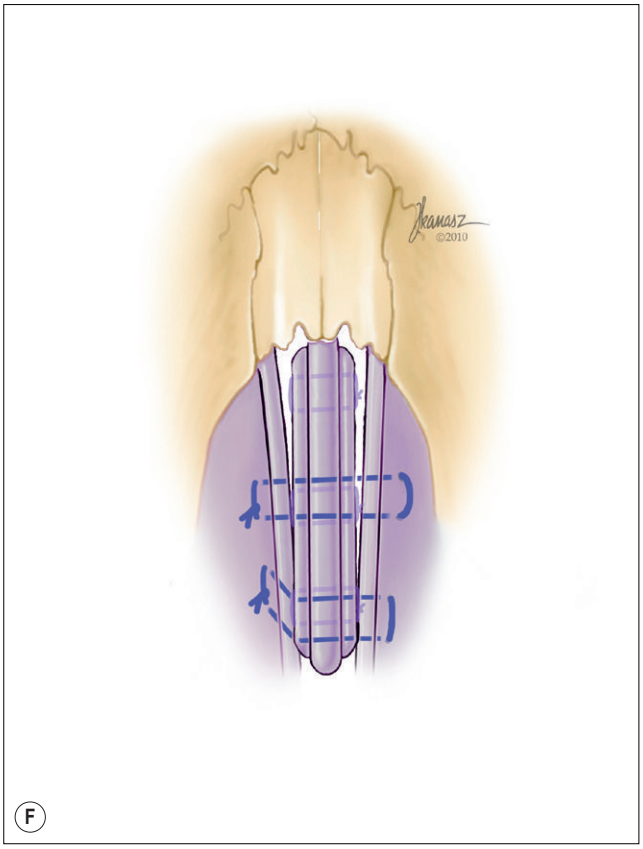
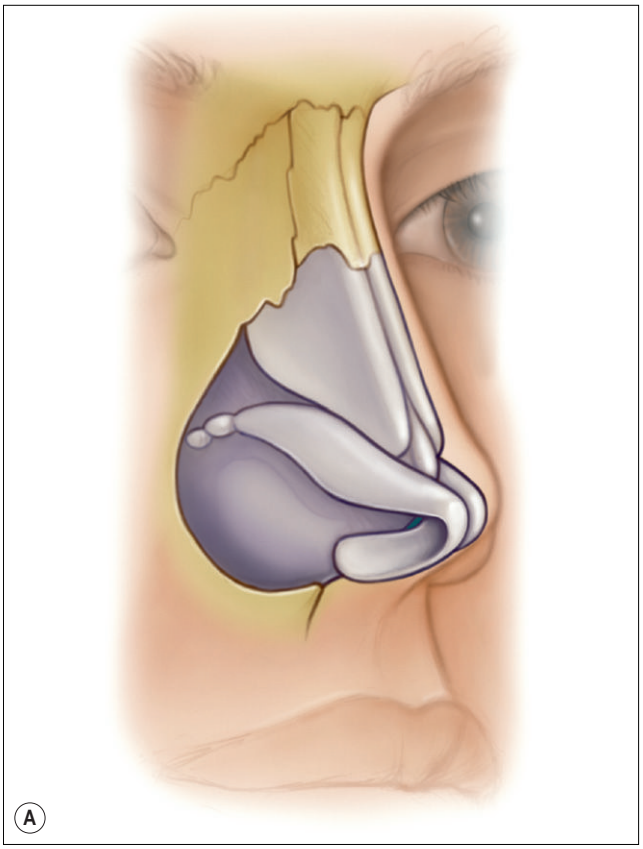


Figure 4.10, cont'd.



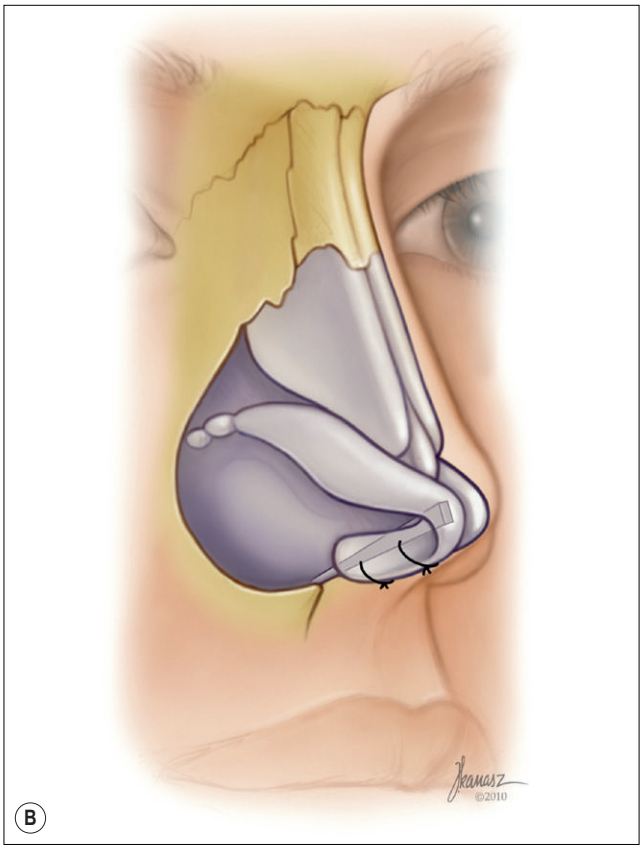


Figure 4.11 An illustration depicting placement of the columella strut.

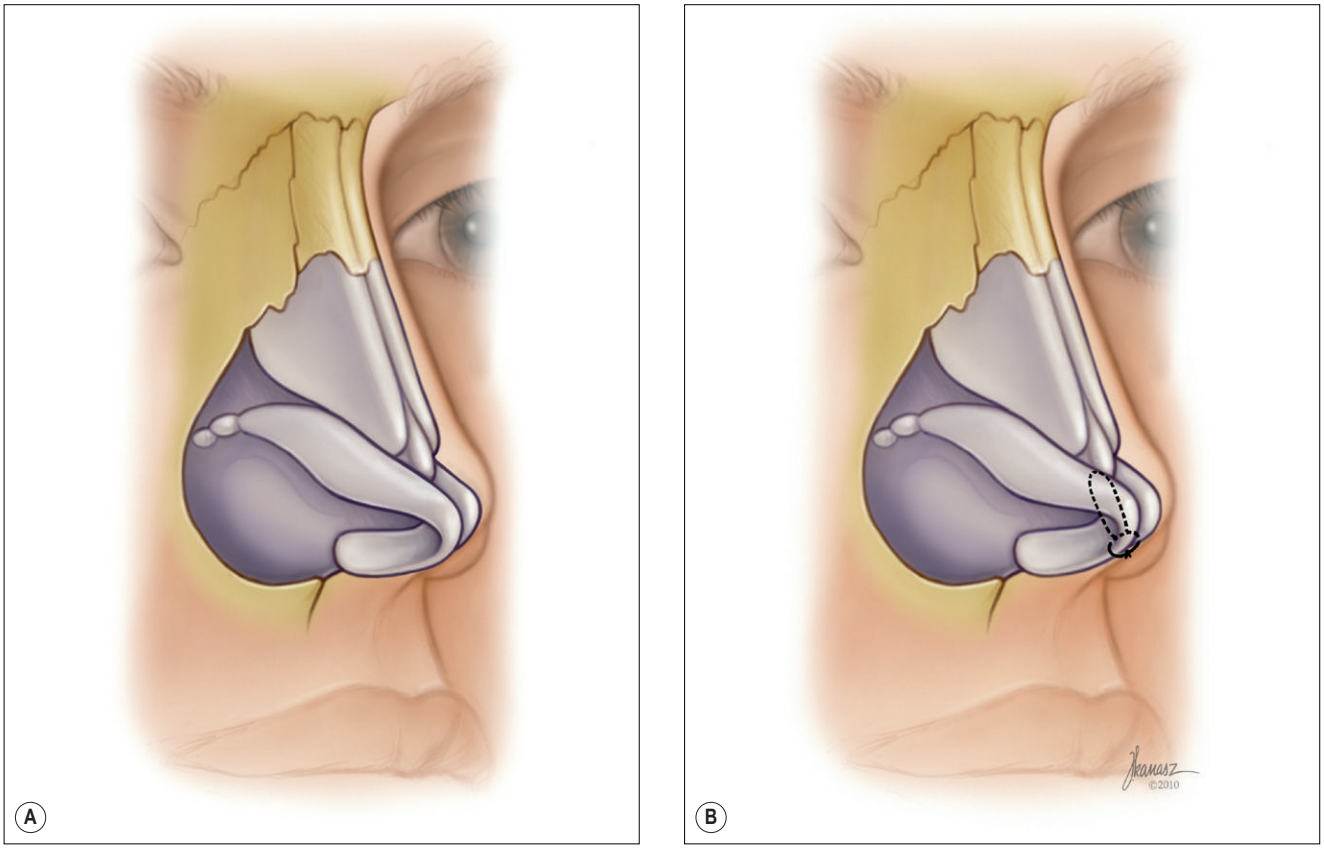


Figure 4.12 An illustration showing placement of a tip rotation suture to change the nasolabial angle.

by the use of one or two medial crura sutures placed along the caudal border of the medial crura.

Tip Rotation

If the tip needs to be rotated cephalically, a triangular shaped piece of cartilage, based anteriorly, and a proportional amount of the membranous septum are excised from the caudal septum through a transfixion incision (Figure 4.12; Animation 4.9; Video 4.21a, b). The goal is to eliminate soft tissue redundancy that otherwise may promote caudal rotation of the tip postoperatively. A tip rotation suture can further rotate and fix the tip in the desired position (Video 4.21c).[1] To rotate the tip, a 5-0 nylon suture is passed through the caudal border of the medial crura and tied. The needle is passed between the medial crura, or between the medial crus on one side and the columella strut if the latter has been used, and then passed through the anterocaudal septum and brought back between the medial crura, or the opposite medial crus and the columella strut. As the suture is tightened incrementally, the tip will rotate cephalically and will remain securely in this position. This type of fixation is extremely important for senescent and Middle Eastern noses.

Animation 4.9 •

Video 4.21a • 4.21b • 4.21c

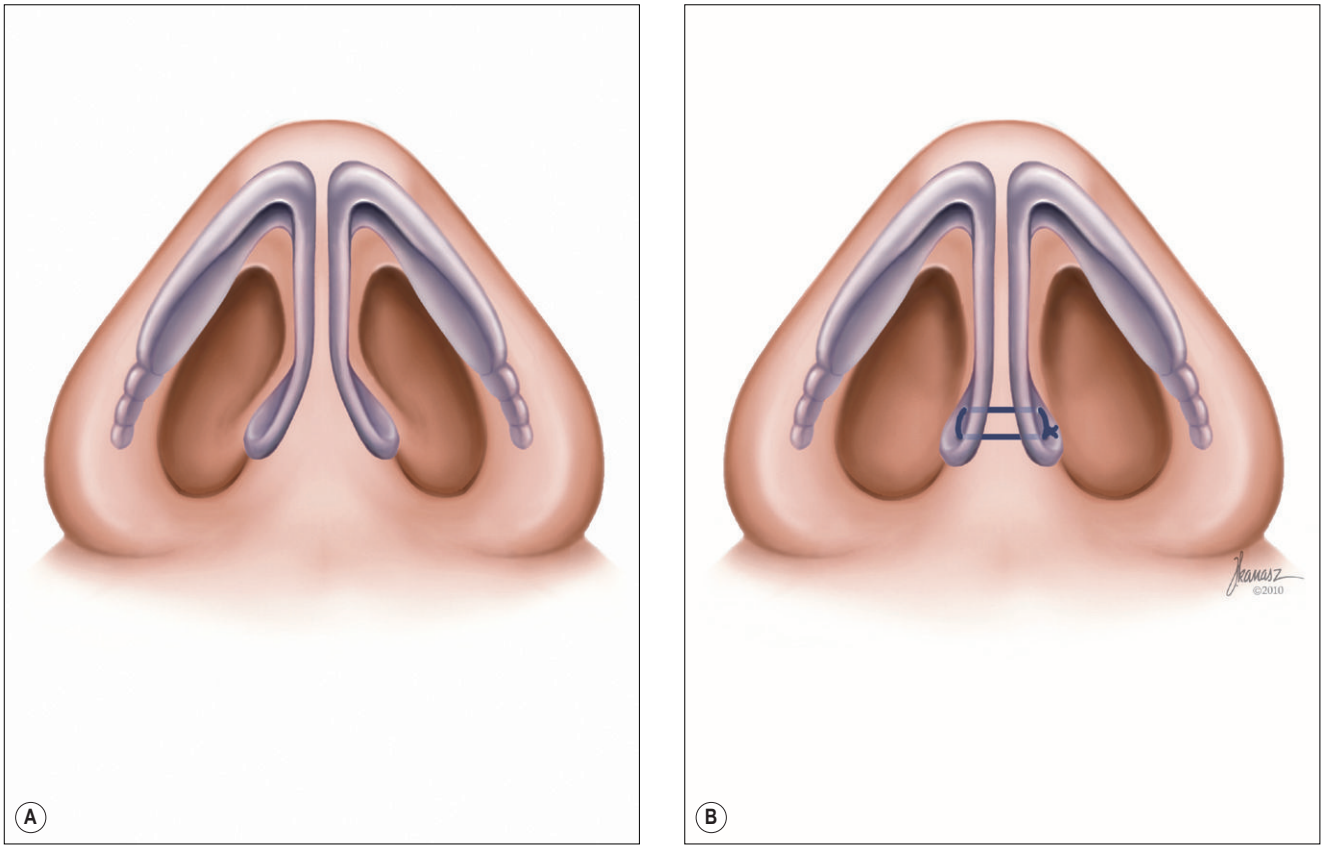


Figure 4.13 Artistic rendering demonstrating approximation of the footplates.

Approximation of the Footplates

If there is a need to narrow the distance between the footplates of the medial crura, the excessive portion of the footplates is trimmed through the existing transfixion incision if the subnasale is not retracted. On noses with retracted subnasale, rotation of the intact footplates medially will augment this deficient zone optimally. If a transfixion incision is not part of the surgical plan, a 4–5 mm incision along the posterior border of the footplate will expose the footplates (Video 4.22a). The suture is passed from one plate to the other with minimal dissection in the membranous septum. As the suture is tied, it will narrow the base of the columella and advance the soft tissues in the subnasale caudally (Video 4.22b). If the soft tissue protrusion is deemed detrimental to the nasal aesthetics, it will be excised by dissecting between the footplates through the transfixion incision prior to approximation of the footplates. Approximation of the footplates will engender more stability in the central portion of the basal nose tripod (Figure 4.13). The membranous septum incision is then repaired using a 5-0 chromic suture. The dead space between the footplates, the caudal septum, and the columella strut is eliminated by placing a through-and-through suture of 5-0 chromis at the level of the footplates.

Video 4.22a • 4.22b

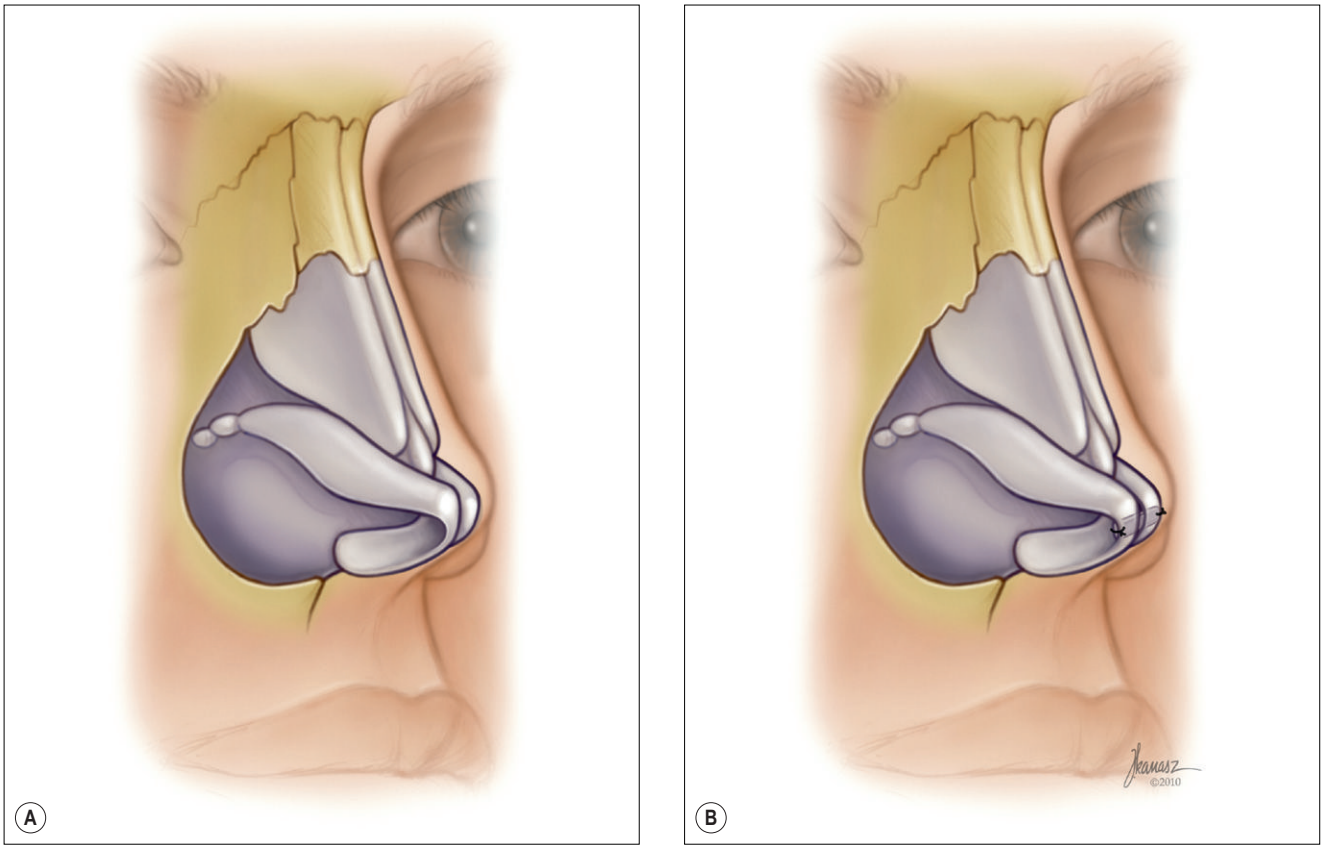


Figure 4.14 An illustration showing placement of a subdomal graft.

Tip Contouring

The domes are assessed at this point. If the domal arches are too wide, a transdomal suture will be used (see Figure 6.2 in Chapter 6). If the domes are ideally shaped but are too far apart due to divergence of the medial genu, an interdomal suture will be utilized (see Figure 6.1 in Chapter 6).[5] If the domes are too close to each other or are asymmetrical, a subdomal graft will be applied.[6] For details related to these sutures, please refer to Chapter 6.

Subdomal Graft

Animation 4.11 •

Video 4.23 •

To place a subdomal graft, a block of 1.5 mm×1.5 mm cartilage measuring approximately 10 mm long is prepared (Figure 4.14; Animation 4.11; Video 4.23). A tunnel is created under each dome using a pair of iris scissors. The cartilage bar is then passed under one dome, extended under the opposite dome, and fixed in position using at least two 6-0 polyglactin sutures.

Tip Graft

For patients with an underprojected tip due to deficiency in the infratip lobule, either an onlay or a shield graft is used. If the tip is merely underprojected, an onlay graft is harvested using the tip punch (Snowden-Pencer; Figure 4.15;

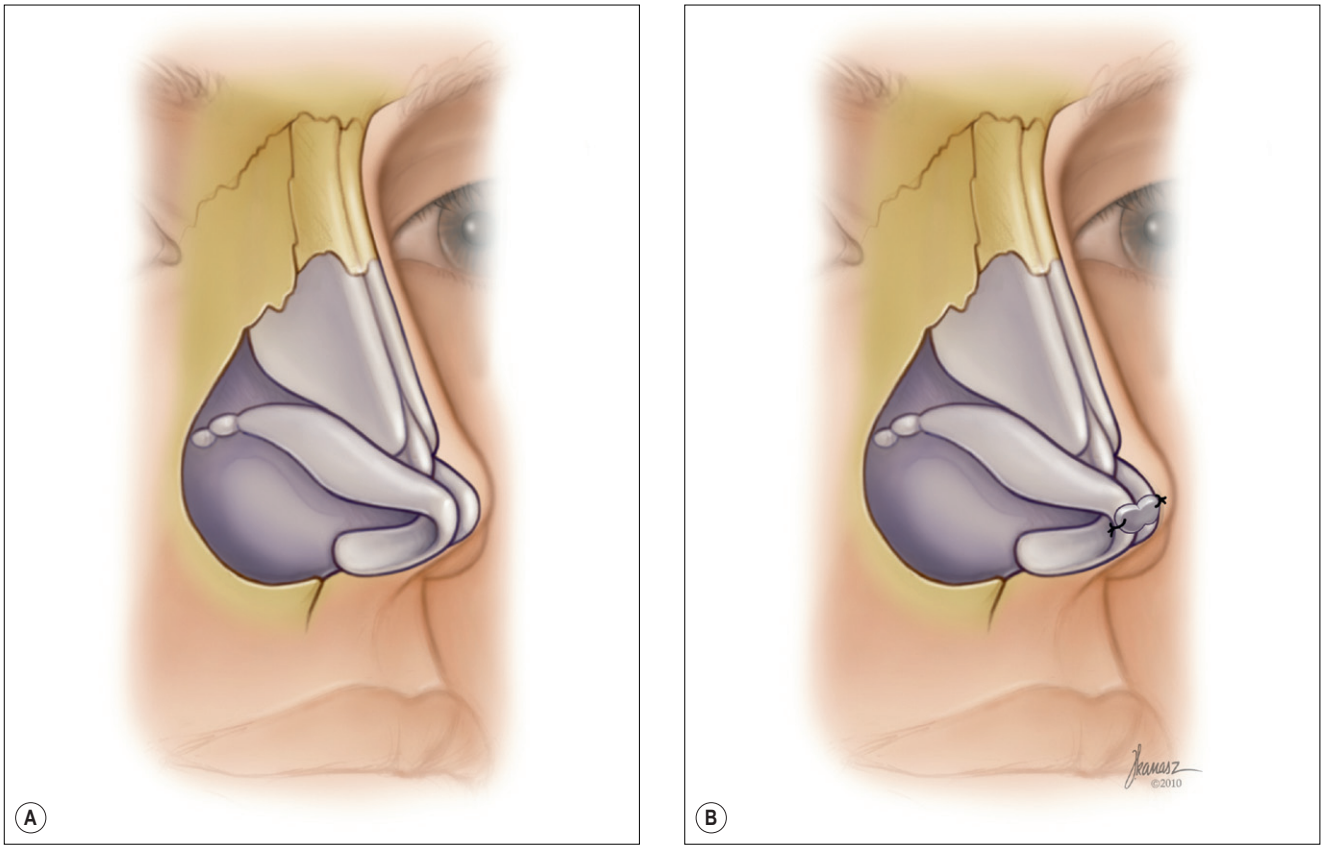


Figure 4.15 An illustration demonstrating placement of an onlay tip graft.

Animation 4.12). If the deficiency is a combination of lack of projection and infratip deficiency, the shield punch is utilized (Figure 4.16; Animation 4.13). Either way, the graft is sutured in position using 6-0 polyglactin while the symmetric position of the graft is checked three-dimensionally.

Animation 4.12 • 4.13

Supratip Sutures

On patients with thick nose skin requiring a supratip suture (Figure 4.17; Animation 4.14; Video 4.24a),[7] a temporary suture is placed through the columellar incision. The supratip break point is selected, a 25 gauge needle dipped in brilliant green is used to tattoo through the full thickness of the skin and the underlying anterocaudal septal angle, and the temporary columellar suture is removed. A supratip suture is placed using a 6-0 poliglecaprone to loosely approximate the subcutaneous tissues to the underlying supratip area. This suture should not be tied tightly, as this can cause soft tissue necrosis.

Animation 4.14 •

Video 4.24a •

Repair of the Columellar Incision

The columellar incision will then be repaired by aligning the angles of the columellar skin flaps, which will precisely guide placement of the sutures. The preferred suture material is 6-0 fast absorbable cat gut (Video 4.24b).

Video 4.24b •

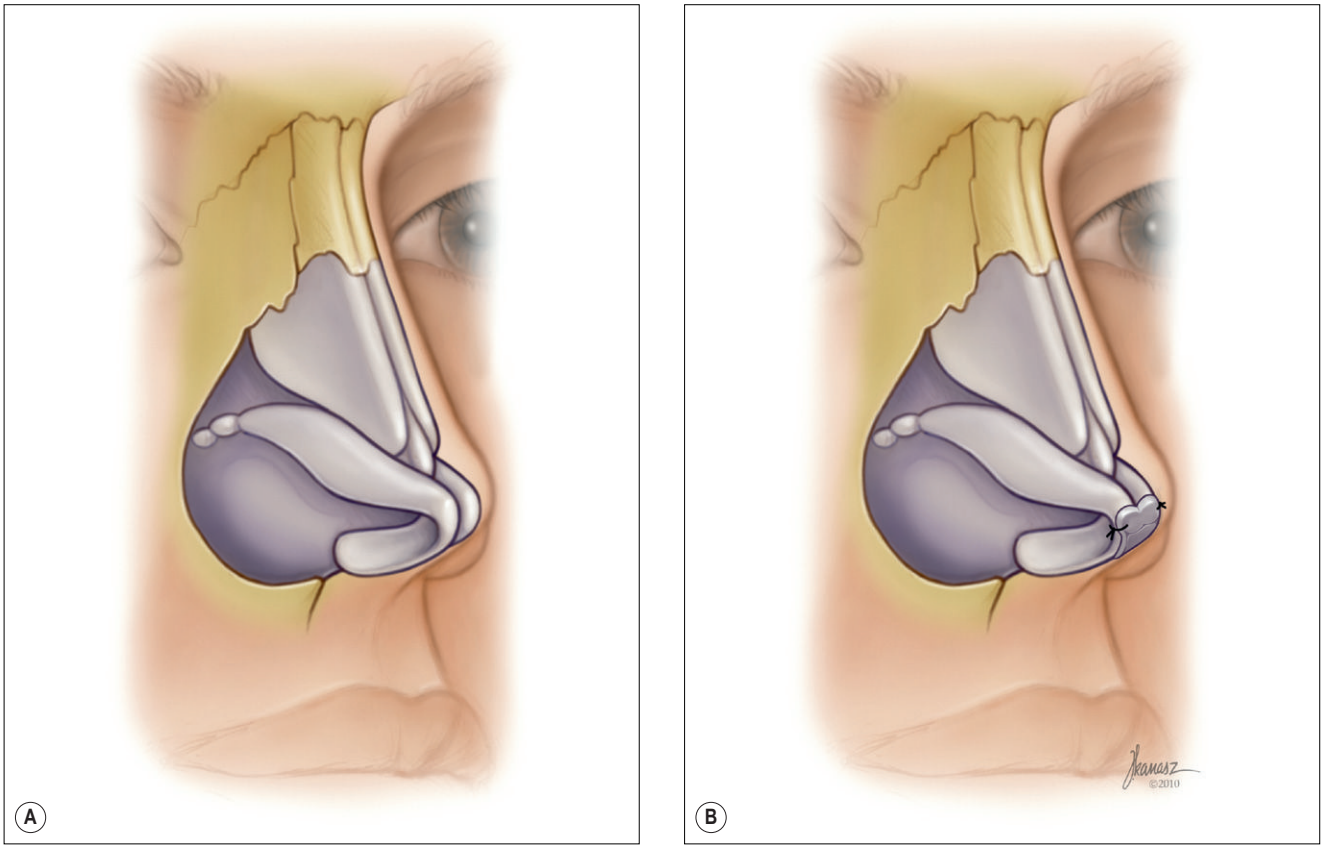


Figure 4.16 An illustration demonstrating placement of a shield graft.

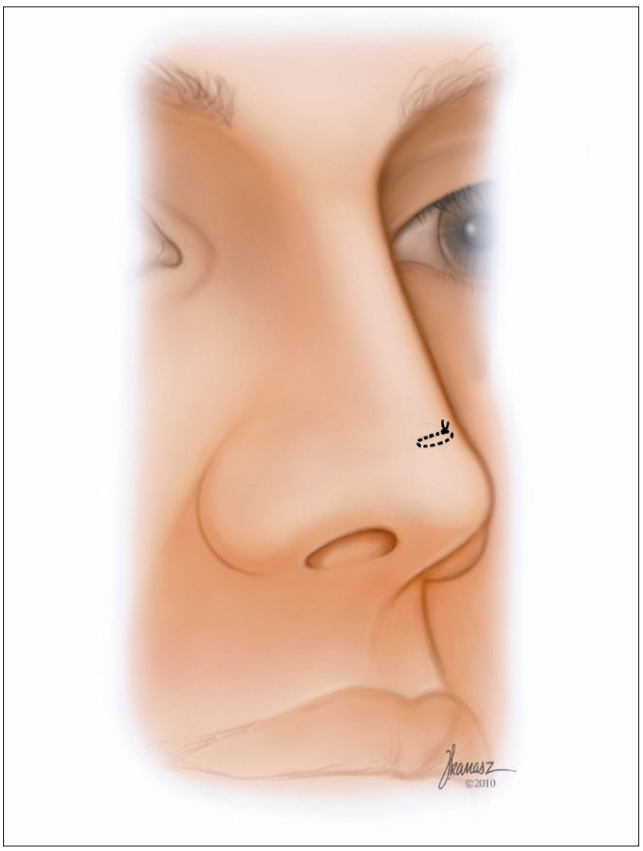


Figure 4.17 Artistic rendering showing that a supratip suture is placed if the caudal dorsal skin is thick.

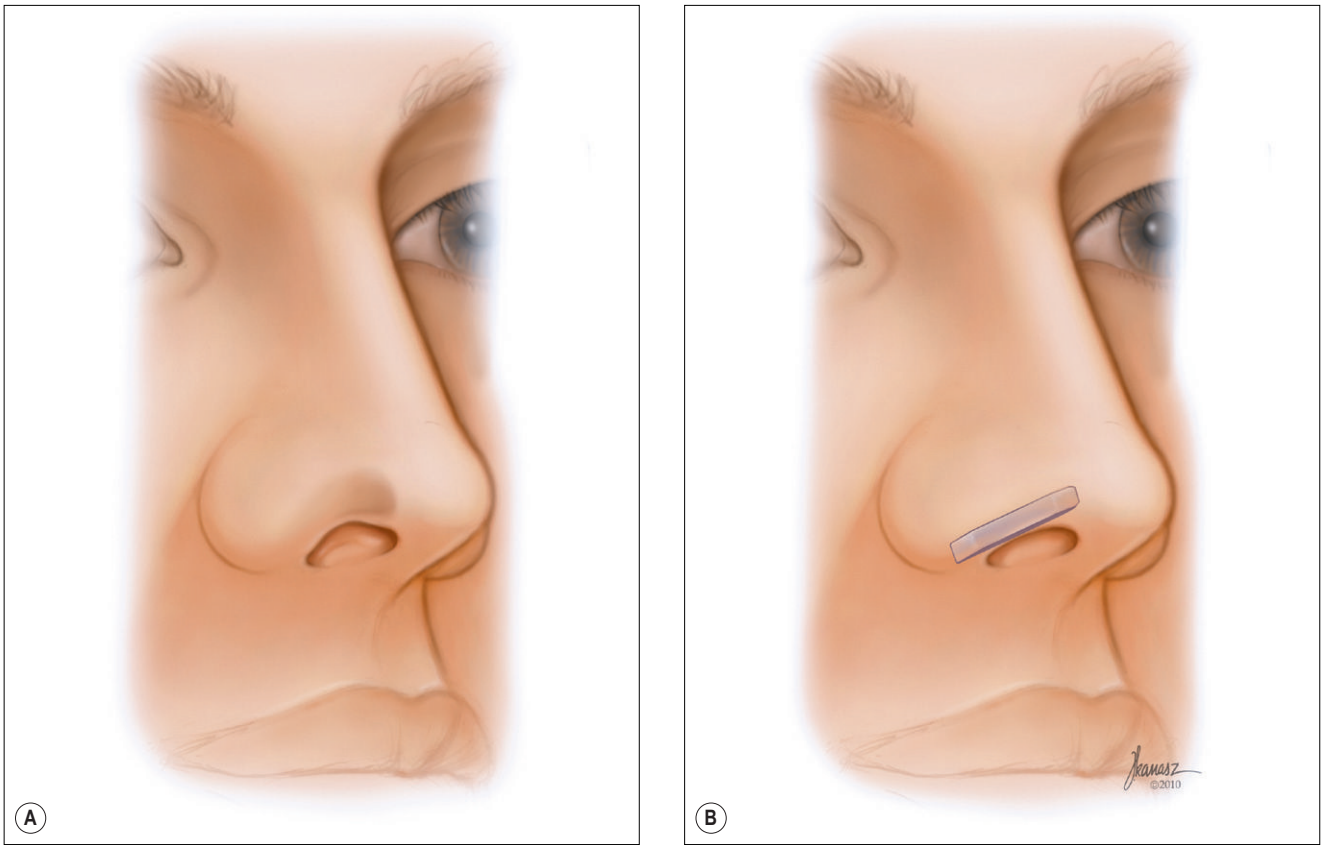


Figure 4.18 An illustration demonstrating placement of the alar rim graft.

Precision is required in order to approximate the skin incision perfectly and prevent notching or irregularities.

Alar Rim Graft

Whenever a weakness of the alar rim is noted, as evidenced by a concave contour or notching, use of an alar rim graft becomes advisable. A graft 13–15 mm long and 2–3 mm wide is crafted from the thinnest portion of the septum or the removed cephalic margin of the LLC (Figure 4.18; Animation 4.15; Video 4.25a). The anterior end of the cartilage graft is beveled to prevent the graft being visible and to provide an elegant transition from the alar rim to the tip. A pair of iris scissors is used to create a pocket within the thickness of the alar rim as close to the rim as feasible. The graft is inserted and fixed in position using a 6-0 catgut suture.[8,9]

Animation 4.15 •

Video 4.25a •

Alar Base Adjustment

Next, the alar base is narrowed (see Chapter 12). The incision is designed in such a way as to maintain the lateral portion of the nostril sill and to provide a graceful transition from the alar base to the nostril sill (Video 4.25b). This

Video 4.25b •

will avoid notching or angulation. It is important to release the alar base muscle to reduce potential widening. Here again, attention to detail is crucial. The incisions are repaired using 6-0 fast absorbable sutures.

Application of Nasal Splint

The nose dressing is a very important part of the rhinoplasty in order to approximate the freed soft tissues to the underlying frame. Mastisol® is then used on the nose skin to help the adhesion of the Steri-Strips™, which are then applied (Video 4.26a). Routinely, a combination of a metal splint and Aquaplast™ over the Steri-Strips™ is used (Video 4.26b). The Aquaplast™ portion of the splint provides stability while the metal portion of the splint aids precise molding of the Aquaplast™ (Video 4.26c). The splint is taped in position using Steri-Strips™.

Video 4.26a • 4.26b • 4.26c

Postoperative Care

Both the splint and the Doyle stents are left in place for 8 days. The Doyle stents are removed before the nose splint is removed in order to avoid an inadvertent lateral displacement of the nasal bones while the stents are being removed. The patient is kept on systemic first-generation cephalosporins during the time the Doyle stents are maintained in position. As long as patients do not have any contraindications such as severe acne, they all receive 10 mg dexamethazone during the surgery and a Medrol dose pack postoperatively to minimize swelling and bruising. The patients are prohibited from engaging in strenuous physical activity for 3 weeks and from wearing glasses for 5 weeks. Beyond 5 weeks, there are no limitations imposed on their activities. The majority of patients do not require any taping after removal of the splint. On patients who have supratip swelling, tapes may be utilized in the evening and through the night for 6 weeks. The patients are kept on antibiotics while the Doyle stents are in place to minimize the potential for toxic shock syndrome.

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9. *Rohrich RJ, Ranier J, Ha RY. The alar contour graft: correction and prevention of alar rim deformities in rhinoplasty. Plast Reconstr Surg 2002;109(7):2495–2505.*

10. *Totonchi A, Eshraghi Y, Beck D, et al. Von Willebrand disease: screening, diagnosis, and management. Aesth Surg J 2008;28(2):189–194.*

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Video 4.1 The nose hair is clipped and the hair particles are removed using adhesive tape.

Video 4.2a If a turbinectomy is indicated, the turbinates are injected bilaterally with xylocaine containing 1 : 200 000 epinephrine using a 25-gauge spinal needle.

Video 4.2b The nose is packed with gauze saturated in Afrin™ or Neo-Synephrine™ solution. This is placed as far cephalically and posteriorly as possible to cause vasoconstriction in the areas that are hard to reach through injection.

Video 4.2c The external nose is injected copiously with xylocaine containing 1 : 200 000 epinephrine with a 27-gauge needle. This injection is started at the radix and, while the left index finger protects the orbital area, the lateral portion of the nose is injected both medial and lateral to the nasal bone on either side. Additionally, the columella, as well as the roof of the nose on either side, is injected to achieve vasoconstriction in the anterior vessels.

Video 4.3 After waiting a few minutes for vasoconstriction to occur, the injection is repeated, this time using 0.5% ropivacaine containing 1 : 100 000 epinephrine and 150 units/ml hyaluronidase. This injection is started at the radix again and, while the index finger protects the orbital area, the lateral portion of the nose is injected both medial and lateral to the nasal bones on each side. Additionally, the columella and the roof of the nose on either side is injected to achieve more vasoconstriction in the anterior vessels.

Video 4.4 The step incision is marked in the narrowest portion of the columella while the nostrils are retracted anteriorly. Prior to the incision, the tip is allowed to retract to ensure that the incision is not too close to the anterior border of the nostrils. The skin incision is then started with a no. 15 blade.

Video 4.5 A small double skin hook is placed in the step incision while a single hook retracts the nostril. The marginal incision is made in the columella and extended into the right nostril while the nondominant middle finger everts the vestibular lining.

Video 4.6 The skin hooks are placed in position and a pair of baby Metzenbaum scissors is used to carefully separate the soft tissues of the columella from the underlying medial crura with a gentle spread and cut technique.

Video 4.7 The soft tissues are separated from the underlying lateral crura of the lower lateral cartilages, staying as close to the cartilages as possible. This is continued until the anterocaudal septal angle is adequately exposed.

Video 4.8 An Obwegeser periosteal elevator is used to elevate the periosteum, taking care to maintain the periosteum attached to the overlying soft tissues.

Video 4.9 A guarded burr is then used to deepen the radix using a side-to-side motion.

Video 4.10a The dorsal hump is removed with a pull-and-push motion using a carbide rasp. The rasping course is oblique and the nasal bones are protected by the fingers to minimize the chance of inadvertent fracture of the nasal bones and septum.

Video 4.10b The goal is to create a step between the optimally contoured nasal bones and the remaining cartilaginous hump to be removed later on the basis of the preoperative assessment.

Video 4.11 The lateral crus stabilizer is then used to harness the lower lateral cartilage. Maintaining a width of about 4–5 mm anteriorly and 6 mm posteriorly, the excess portion of the cartilage is removed.

Video 4.12a The soft tissue overlying the anterocaudal septum is then removed to expose the anterocaudal septum.

Video 4.12b Using the sharp end of the septal elevator, the mucoperichondrium is separated from the anterocaudal septal cartilage. Sometimes it is necessary to score the mucoperichondrium with a no. 15 blade to initiate the dissection in the proper plane. Exposure of the gray, shiny cartilage is an indication that the right dissection plane has been entered. At this point, using the roll of the septal elevator, the mucoperiochondrium is separated from the overlying lower lateral cartilages and the roof of the nose.

Video 4.13ai The upper lateral cartilages are separated from the septum using a pair of Joseph scissors.

Video 4.13aii The cartilaginous dorsal hump is now removed using a no. 15 blade.

Video 4.13bi The mucoperichondrium is dissected along the caudal border of the septum on both sides.

Video 4.13bii The dissection is continued along the left side of the septum in the submucoperichondrial plane as far posteriorly and caudally as possible.

Video 4.13biii The mucoperichondrium attached to the caudal septum is carefully separated and the dissection is continued until the vomer bone is exposed. It is often easier to start the dissection posteriorly and continue it anteriorly.

Video 4.13biv The sharp end of the septal elevator is used to incise the septal cartilage leaving at least 1.5 cm anteriorly and caudally to maintain the dorsal support. Next, the mucoperichondrium is elevated on the right side of the septum as far posteriorly and caudally as possible.

Video 4.13bv The septal elevator is then used to separate the caudal septum from the vomer bone caudally with a great deal of patience and care to avoid perforation of the mucoperichondrium. The dissection is advanced posteriorly until the entire quadrangular cartilage is separated from the maxillary crest of the vomer bone. The cartilage is also separated from the perpendicular plate of the ethmoid bone with the sharp end of the elevator. The completely mobilized cartilaginous septum posterior and caudal to the L strut is then removed.

Video 4.13bvi The mobilized portion of the quadrangle cartilage and the residual portion of the deviated cartilage, which is often dislodged to one side of the septum, are removed.

Video 4.13bvii The crest of the vomer bone is also removed, if deviated. Often, this part of the septum protrudes to one side as a spur. The resection is continued until all the irregularities are eliminated. Sometimes it is necessary to cauterize the vessels along the base of the vomer bone to minimize the potential for postoperative bleeding.

Video 4.13c One of the critical aspects of septoplasty is removing the overlapping portion of the caudal septum, which is often dislodged to one side of the septum. This will allow for a swinging-door-type movement of the septum.

Video 4.13d The mobilized caudal septum is then repositioned over the anterior nasal spine and fixed into position using 5-0 PDS suture. However, it is crucial to make sure that the nasal spine is in the correct position prior to fixing the septal cartilage to it.

Video 4.14a The turbinates are then conservatively trimmed using a pair of turbinate scissors, removing only the redundant portion and leaving normal-sized turbinates behind.

Video 4.14b The suction cautery is then used to gently cauterize the raw surface of the turbinates to minimize postoperative bleeding.

Video 4.15 Doyle stents covered with bacitracin ointment are then introduced into each side of the nasal cavity and fixed into position using a 4-0 polypropylene suture passed through the membranous septum. The ends of the suture are left long so they can be easily identified and are placed inside a tube in order to avoid irritation of the nasal lining.

Video 4.16 The medial osteotomy is initiated with a 4 mm osteotome placed medial to the nasal bone and the osteotomy is completed with gentle tapping on the osteotome.

Video 4.17 The lateral anteroposterior percutaneous osteotomy is accomplished using a 2 mm carbide osteotome. It begins anteriorly and is extended posteriorly in the subperiosteal plane.

Video 4.18ai The lateral osteotomy begins with a stab wound incision in the vestibular lining close to the pyriform aperture. A Joseph's elevator is then used to create a tunnel in the subperiosteal plane over the nasal bones.

Video 4.18aii The lateral osteotomy is then started using a guarded osteotome, which is gently advanced in the subperiosteal plane while its position is monitored with the index finger of the nondominant hand. Upon completion of the osteotomy, the nasal bone can be moved medially with gentle pressure.

Video 4.18b The upper lateral cartilages are trimmed after completion of the osteotomy.

Video 4.19a Spreader grafts are prepared using a piece of straight septal cartilage and the ends are beveled to minimize visibility.

Video 4.19b The spreader grafts are then placed into position, extending from underneath the nasal bones to the caudal end of the upper lateral cartilages, and are fixed in position using a double armed 5-0 polyglactin suture. After one needle is passed, the position of the spreader grafts is adjusted and then the second needle is passed and the suture is tied to align the cartilages with the dorsum. At least two sutures are utilized to avoid rotation of the graft. Again, the position of the grafts is monitored throughout this process to ensure proper alignment and symmetry.

Video 4.20a The upper lateral cartilages are then approximated to the septum using 5-0 PDS. Since the intention is to rotate the anterior septum to the left side, the stitch is placed more cephalad on the left side and more caudally on the right side. In this way, using the left upper lateral cartilage as an anchor, the septum can be rotated to that side. As the suture is tightened, the septum rotates to the patient's left to be aligned with the rest of the facial structures. A second suture is often necessary to avoid bulging of the upper lateral cartilages. These stitches should be placed as anteriorly as possible to avoid constriction of the internal valves.

Video 4.20bi The columella strut is prepared using the longest and straightest portion of cartilage available. In fact, this is the first piece that is harvested. The length of the graft is, to a great extent, dependent on its purpose.

Video 4.20bii The soft tissue between the middle crura is excised using the coagulation power of the cautery.

Video 4.20biii The columella strut is placed in position while the domes are aligned and retracted with a double skin hook. Using methylene blue and brilliant green, the columella is tattooed with a 25-gauge needle.

Video 4.20biv Guided by the tattoo marks and using 5-0 PDS, two stitches are placed through the medial crus on one side, passed through the columella strut and the opposite medial crus, and tied in position to ensure proper alignment of the cartilages. The second stitch is placed in a similar fashion, aligning the medial crura and the columella strut. Prior tattooing of the medial crura and the columella strut avoids unnecessary repeated replacement of the sutures. The excess portion of the columella strut is then trimmed if necessary.

Video 4.21a A transfixion incision is made along the cephalic border of the medial crura and the redundant portion of the membranous septum is excised to facilitate cephalic rotation of the tip.

Video 4.21b The caudal septum is then excised in a triangular shape based anteriorly to facilitate cephalic rotation of the tip.

Video 4.21c A tip rotation suture is placed using 5-0 nylon. The suture is passed through the medial crura and tied, and the needle is then passed in between the medial crus on one side and the columella strut. A bite is taken of the anterocaudal septum including a minimal amount of soft tissue and the suture is then passed between the opposite medial crus and the columella strut and tied incrementally to oppose the cephalic border of the medial crura to the caudal border of the septum. The tip position should be carefully monitored throughout this process.

Video 4.22a The footplates are exposed through the transfixion incision and the redundant portion is excised if necessary.

Video 4.22b If the footplates are displaced laterally, a 5-0 PDS suture is passed through the footplate on one side and then passed to the opposite side cephalad to the footplates. The suture is then passed through the opposite footplate and tied incrementally.

Video 4.23 A subdomal graft is being placed by creation of a pocket under each dome first. A piece of cartilage graft usually measuring about 10 mm long, 1.5 mm thick, and 1.5 mm wide is passed under the dome on one side and then passed under the opposite dome and fixed in position using 6-0 polyglactin sutures. At least two and often three sutures are needed to avoid dislodgment of the graft.

Video 4.24a Next, a supratip suture is placed if needed. To do so, a temporary columella suture is placed and the supratip breakpoint is identified and tattooed using a 25-gauge needle and methylene blue. The supratip skin is approximated to the underlying anterior septal angle guided by the tattoo marks.

Video 4.24b The columella incision is then repaired using 6-0 fast-absorbable catgut sutures. The angles of the step incision aid the precise placement of the sutures.

Video 4.25a A graft 10–12 mm long and 2–3 mm wide is crafted from the thinnest portion of the septum or the removed cephalic margin of the lower lateral cartilage. The anterior end of the cartilage graft is beveled to avoid visibility. A pair of iris scissors is used to create a pocket within the thickness of the alar rim as close to the rim as possible. The graft is inserted and fixed in position using a 6-0 fast-absorbable catgut suture.

Video 4.25b The alar base incision is designed by removing most of the tissue from the nostril sill, leaving enough laterally to facilitate a graceful transition from the alar rim. The incision is made using a no. 15 blade while the soft tissues are retracted. The alar base is excised using a combination of knife and electrocautery needle and the muscles at the base of the excised area are released and cauterized gently. The incision is then repaired using 6-0 fast-absorbable catgut and the lateral flap is approximated to the medial flap in a very precise fashion using multiple stitches.

Video 4.26a The nose dressing is a very important part of the rhinoplasty in order to approximate the freed soft tissues to the underlying frame. Mastisol® is used on the nose skin to help the adhesion of the Steri-Strips™, which are then applied precisely.

Video 4.26b Routinely, a combination of a metal splint and Aquaplast™ is used over the Steri-Strips™.

Video 4.26c The Aquaplast™ portion of the splint provides stability while the metal portion of the splint aids precise molding of the Aquaplast™.

CHAPTER 5

Variations in Nasal Osteotomy: Consequences and Technical Nuances

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Animations

Pearls

- As the osteotomy is completed and the nasal bones are medialized, if the anterior portion of the inferior turbinate extends anterior to the plane of the osteotomy, it will be medialized as well.
- On patients who have an anteriorly positioned turbinate, the lateral osteotomy can be high-to-low rather than low-to-low to minimize the ill effects on the airway.
- As the nasal bone is medialized, it will reposition the upper lateral cartilage medially. The longer the nasal bone, the more influence it will have on the upper lateral cartilage.
- If the medialization of the inferior turbinate is recognized intraoperatively, the protruding portion of the inferior turbinate can be reduced conservatively.

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- It is important to complete the lateral portion of the wedge osteotomy first. Otherwise, if the osteotomy on the medial portion of the wedge is completed first and the nasal bone becomes unstable, it will be very difficult, if not impossible, to complete the lateral portion of the wedge osteotomy.
- Using lateral osteotomy without medial or cephalic osteotomy can result in an unfavorable fracture extending through the least resistant portion of the lateral nasal wall, causing irregularities anteriorly.
- When a low-to-high osteotomy is performed, one may see or palpate a step deformity or grooving of the nasal bone which is aesthetically displeasing.
- To eliminate the grooving secondary to an anteriorly positioned osteotomy (low-to-high), a second osteotomy is necessary posteriorly to reposition the residual lateral segment of the bone.

One of the most consequential maneuvers in rhinoplasty is nasal bone osteotomy, the importance of which has not been sufficiently emphasized. An improper, and even a proper, osteotomy can result in some adverse effects, avoidance of which can make the rhinoplasty much more successful. The technique of nasal bone osteotomy was discussed in Chapter 4. In this chapter, we will discuss the consequences of the nasal bone osteotomy and the nuances that make a difference in the final outcome.

Almost any time a large hump is removed, an osteotomy becomes mandatory to avoid excess width of the dorsum. This may not be clear during the initial observation of the patient's nose. In fact, there are noses that appear too narrow and one can only recognize the need for osteotomy with the aid of foresight. Palpation of the nasofacial junction can help in this regard and can lead the surgeon to the conclusion that after removal of a narrow dorsal hump an osteotomy will be unavoidable. Removal of a large dorsal hump will often result in an open roof with a square and wide dorsal configuration (Figure 5.1; Animation 5.1). Every effort should be made to maintain the integrity of the mucoperiosteum along the roof of the nose, which can be valuable in controlling the dorsal width. The choice of the osteotomy will be dictated by a variety of factors, which will be discussed later in this chapter.

Animation 5.1 •

Functional Consequences of Osteotomy

In a study involving intraoperative measurement of the distance between the inferior turbinate and the septum, our team has clearly demonstrated that, as the osteotomy is completed and the nasal bones are medialized, if the anterior portion of the inferior turbinate extends anterior to the plane of the osteotomy, it will be medialized.[1] This will invariably result in reduction of the airway (Figure 5.2a). This adverse effect on the airway can be avoided in one of several ways. First, rather than a low-to-low osteotomy, it is possible to

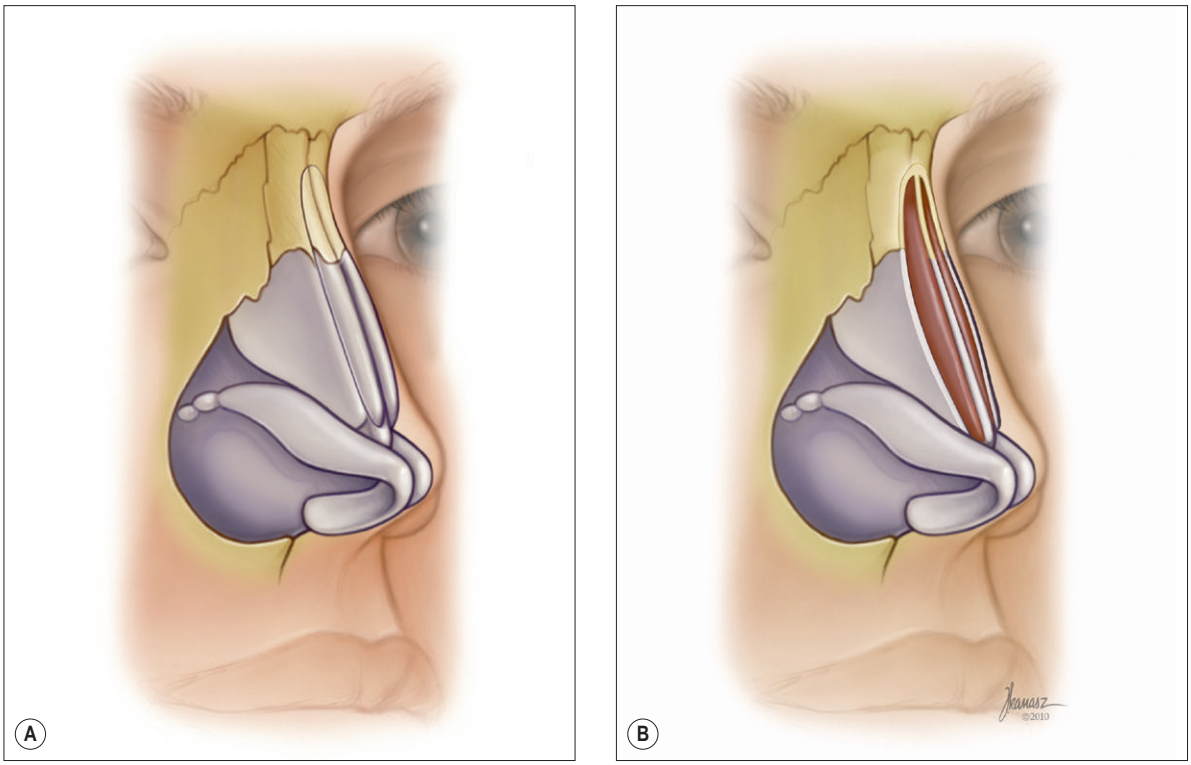

Figure 5.1 (A) As the dorsal hump is removed, a square shaped dorsum will result (B), which mandates bilateral osteotomies.

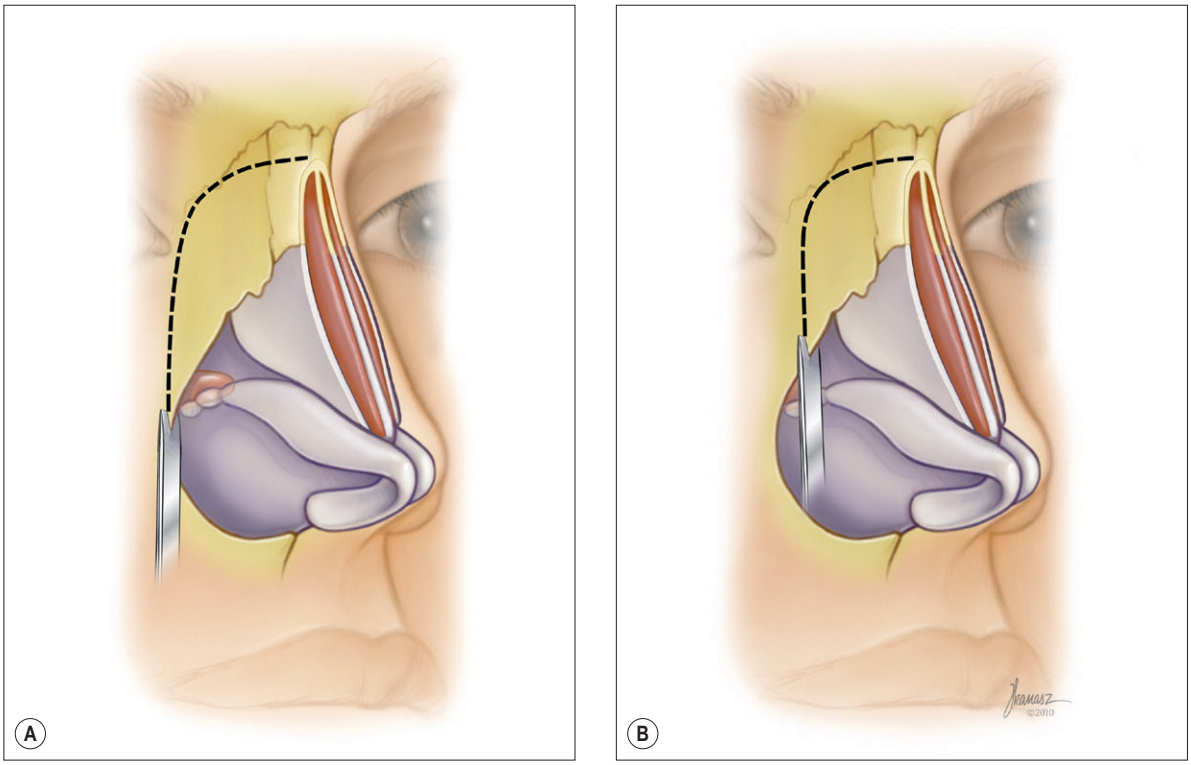

Figure 5.2 (A) If the anterior portion of the inferior turbinate extends anterior to the plane of the osteotomy, this results in medialization of the inferior turbinate and disturbance of the airway as the osteotomy is completed and the nasal bone is medialized. (B) To avoid this, one can begin the osteotomy more anteriorly.

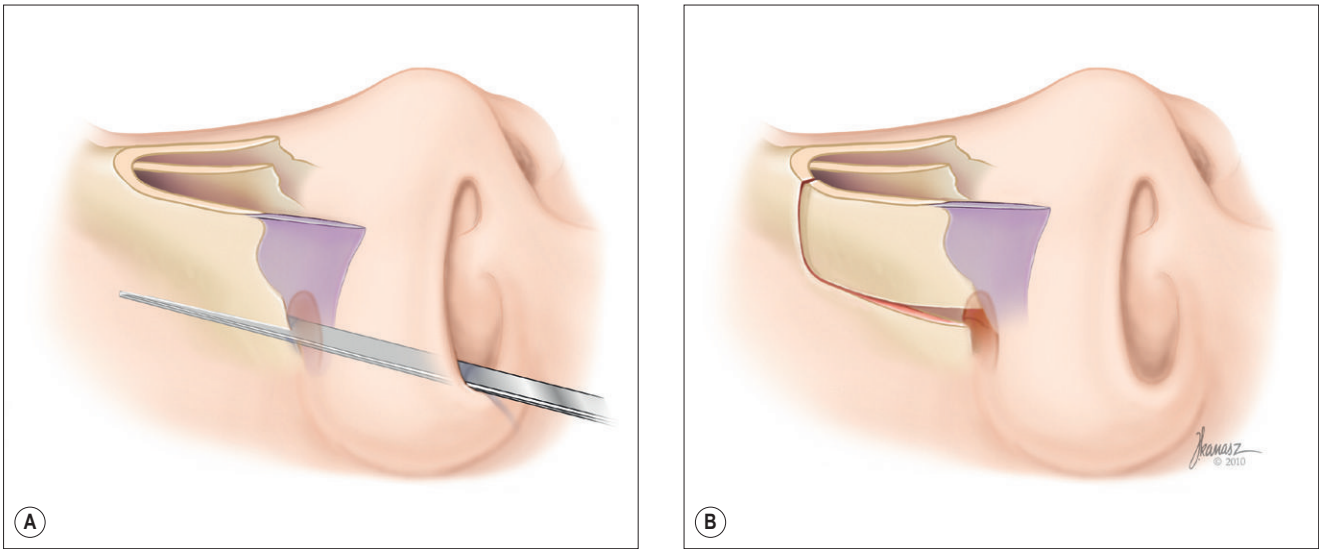

Figure 5.3 As the medial, anterior–posterior, and cephalocaudal osteotomy is completed and the nasal bone is moved medially, the upper lateral cartilage will be repositioned.

start the osteotomy anterior to the limits of the inferior turbinate and extend it posteriorly along the nasofacial junction up to the nasal bones (Figure 5.2b). In other words, a high-to-low osteotomy is performed rather than a low-to-low osteotomy. Second, one may trim a small portion of the medialized inferior turbinate and gently cauterize the raw surface. Third, the osteotomy can be avoided, although this is often not a good compromise aesthetically. Additionally, the upper lateral cartilages are attached to the medial surface of the nasal bones. As the osteotomy is completed and the nasal bone is moved medially, it will reposition the upper lateral cartilage (Figure 5.3; Animation 5.2) Animation 5.2 • Therefore, it is essential in these circumstances to use a spreader graft or flap to avoid significant medialization of the upper lateral cartilage. One or two layers of spreader graft will be needed, depending on the thickness of the available cartilage. This will not only become functionally beneficial, it will also reduce the potential for an inverted V deformity, which often develops several months to several years after the rhinoplasty, depending on the thickness of the skin. This deformity is almost invariably associated with an internal valve dysfunction, especially at night while the patient is in a supine position.

Aesthetic Concerns

An irregular dorsal line related to uneven nasal bones is one of the most common reasons for revision rhinoplasty. This is often the consequence of an uncontrolled osteotomy. It is for this reason that in Chapter 4 the importance

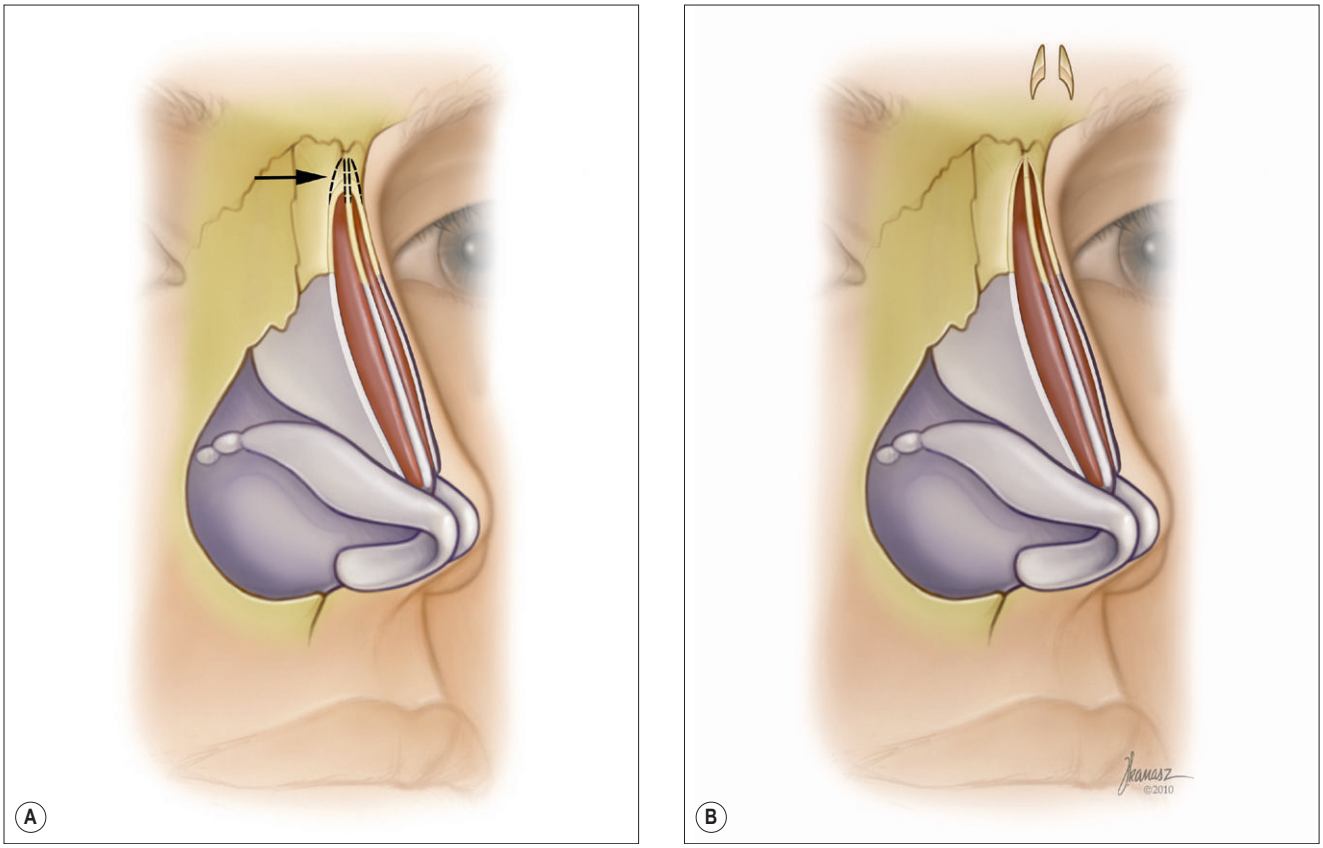

Figure 5.4 In a nose with a very wide dorsum, it is necessary to remove a wedge of bone based caudally to permit repositioning of the nasal bone.

of a combined medial, anteroposterior, and posterior (cephalocaudal) osteotomy was stressed. On rare occasions, when the excess width is purely posterior, the anterior width of the dorsum is ideal, and the dorsal outline appears symmetrical, a posterior osteotomy alone may suffice. However, this is seldom the case. Excessive bone between the nasal bone and the midline may prevent repositioning of a nasal bone that is displaced too far laterally. This will result in postoperative excess nasal width and asymmetry and, consequently, patient and surgeon dissatisfaction. This can often be avoided by a wedge resection (Figure 5.4). To complete a proper wedge osteotomy, one must advance a 4 or 6 mm osteotome along the medial surface of the nasal bone and extend the osteotomy cephalically and medially. It is important to complete the lateral portion of the wedge osteotomy first. Otherwise, if the osteotomy on the medial portion of the wedge is completed first and the nasal bone becomes unstable, it will be very difficult, if not impossible, to finish the lateral portion of the wedge osteotomy. The medial wedge osteotomy is initiated lateral to the septum and extended cephalically and laterally to join the previous osteotomy. A full-thickness wedge of bone is removed. If the posterior segment of the wedge is left in place, it will inhibit repositioning of

the nasal bone and produce a great challenge in achieving optimal narrowing of the dorsum. Next, the percutaneous anteroposterior osteotomy is begun where the nasal bones diverge. It is crucial not to use an external anatomical landmark, such as the medial canthus or the supra-tarsal crease, as a reference. Otherwise, the osteotomy could become very cumbersome and it may not be possible to move the nasal bones properly. Placing the anteroposterior osteotomy at the point of divergence of the nasal bones ensures proper mobilization and optimal medial repositioning of the nasal bone. It is also crucial not to allow the nasal bone to become too mobile and sink posteriorly. Should this occur, after placement of spreader grafts, one can approximate the upper lateral cartilages to the grafts while the nasal bones are repositioned and held in place. Since the upper lateral cartilages are attached to the nasal bones, they can stabilize the nasal bone using the septum. If there is any question about the stability of the nasal bones, or if the septum collapses along with the nasal bones, horizontal placement of two percutaneous through-and-through K wires, engaging both nasal bones and the septum, will stabilize the nasal bones until they heal. The K wires can be removed in 2–3 weeks.

On rare occasions, one may see a cephalocaudal C curve (convexity) involving the right nasal bone or a reverse C curve involving the left nasal bone, which may make the medial repositioning and straightening of the nasal bone challenging. Removal of a cephalic wedge will often improve the position of the nasal bone but may not remove the convexity completely. In this case, a bone bender or strong hemostat is used to fracture the nasal bone anteroposteriorly in order to flatten it. Again, this is rarely needed and the nasal bone can frequently be repositioned medially without too much difficulty.

If a controlled osteotomy is not carried out and one only performs a low-to-low or low-to-high osteotomy without weakening of the nasal bone cephalically and medially, this can result in an unfavorable fracture extending through the least resistant portion of the lateral nasal wall, the suture between the nasal process of the frontal bone and the nasal bone. This fracture often results in a spicule protruding laterally. This may not be discernible intraoperatively but will become evident several months to years after surgery, depending on the size of the bone spur and the thickness of the overlying soft tissues. However, with careful palpation, one can often detect and eliminate this irregularity. It is important to avoid an unfavorable fracture by controlling the osteotomy using the combined medial, cephalic, and lateral osteotomy described here. Should this occur, any irregularities that are noticed intraoperatively should be eliminated with a rongeur, which is a more practical tool in this situation than a rasp.

On some secondary rhinoplasties, especially going back to the 1970s and 1980s when the low-to-high osteotomy was routinely advocated, one may see or palpate a step deformity or grooving of the nasal bone. This configuration may rarely be observed during a primary rhinoplasty. Regardless of the primary or secondary nature of this condition, the solution is to perform

another low-to-low osteotomy further posteriorly at the nasofacial junction and reposition the laterally displaced segment medially to create a more pleasing outline to the lateral nose.

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CHAPTER 6

Tip Sutures

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Pearls

- The tip sutures have a specific purpose to serve. However, there are often some unintended changes that occur, an understanding of which is crucial to provide a successful outcome.
- To change the shape of the cartilage, an absorbable suture material lasting only a few weeks, as opposed to a permanent suture, is sufficient.

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- Whenever the suture has to overcome a continuous force such as gravity, for instance in tip rotation, permanent suture material is more reliable.
- The interdomal suture will narrow the tip, strengthen the tip support, increase the lobule volume, reduce the overall tip width and eliminate any clefting that may exist between the domes.
- The transdomal suture, besides narrowing the tip, will result in increase in tip projection, gain in infratip volume, flattening or concavity of the lateral crus, and reduction in interdomal distance.
- If the transdomal suture is placed caudally, it will rotate the lateral crus caudally; if it is placed cephalically, it will rotate the lateral crus cephalically.
- The middle and medial crura suture can be placed caudally, cephalically, or in the mid-portion of the width of the medial crura.
- The middle and medial crura suture narrows the width of the columella, reduces the interdomal distance, creates more stability in the central portion of the basilar nasal tripod, rotates the lateral crura caudally if it is placed along the caudal border of the medial crura or cephalically if it is placed along the cephalic border of the middle crura.
- The medial crura suture widens the nostrils and may cause some fullness caudally.
- The anterior medial crura-septal anchor suture will increase the tip projection, separate the domes slightly if they are not sutured to each other, rotate the tip cephalically, widen the nasolabial angle and elongate the columella and nostrils.
- The posterior medial crura-septal anchor suture not only reduces the tip projection, it will also result in narrowing the distance between the domes if they have not been stabilized, and will rotate the tip caudally, and shorten the columella and the nostrils.
- The tip rotation suture not only rotates the tip cephalically, it may retract the columella minimally.
- The lateral crura spanning suture is used to reduce the convexity of the lower lateral cartilages. It also narrows the distance between the domes, retracts the ala, and elongates the central portion of the nose.
- The lateral crura convexity suture alters convexity, resulting in slight elongation of the nose and a better tip.
- The footplate suture is used to reduce the distance between the divergent plates, which also creates more stability in the central portion of the nasal base tripod and advances the subnasale caudally; it reduces the effectiveness of the depressor nasi septi muscle.
- Complications of suture technique include too much narrowing of the tip, alar retraction, infection, palpability and extrusion.

One fundamental reason for the recent success and predictability of rhinoplasty is the development and proper use of tip sutures. On the other hand,

one of the most common indications for revision tip surgery is an improperly selected or executed tip suturing technique. It is therefore essential to understand the indications for each suture and its intended and unintended effects, and to master this very useful technique.

Joseph first described the use of a suture technique to lessen the distance between the domes and also to rotate the tip cephalically by anchoring the medial crura to the caudal septum. He called this the 'orthopedic suture' and first published his work in 1931.[1] Multiple sutures have since been described addressing specific problems related to the nasal tip and septal curvature. Some of the earlier tip sutures were used to correct cleft lip nose deformity by repositioning the distorted lower lateral cartilages and domes.[2] McCullough[3] and Tardy[4] described the initial forms of the transdomal suture, which is used very commonly today to control the width of the domal arches. Daniel[5] and Tebbetts[6,7] additionally refined tip sutures. Gruber described the lateral crura convexity suture in 1997[8,9] and the author[10] described the sutures that control the footplates. In a comprehensive review, the author discussed the goal of each suture and outlined the variety of changes that occur as a result of each suture, which may or may not be part of the aesthetic goals.[11,12]

Essentially every tip suture can be placed through an endonasal approach. However, an open approach provides a better opportunity to place the sutures more precisely and with greater ease. In this chapter, we will describe each suture and its intended objective and the different dynamic changes that each suture may induce. It is crucial to understand that these sutures cannot be used interchangeably and that each suture has a well-defined function and is designed to achieve a precise objective. It is also of paramount importance to recognize the multiple interplays resulting from each suture, which can be synergistic, antagonistic or unrelated to the overall aesthetic goals of rhinoplasty. Up to 3 years ago in the author's own practice, in the absence of evidence-based knowledge regarding the lasting effects of sutures, many suturing techniques were carried out using permanent suture material. However, a study conducted by the author's research team demonstrated that sutures that last six weeks or more can provide as enduring a result as those that are permanent.[13] Armed with this information, the author's current practice is to use 5.0 PDS for reshaping the tip cartilages, except for the tip rotation and suspension suture, where the goal is to eliminate the distance between the medial crura and the anterocaudal septum as well as to overcome the continuous force of gravity and the depressor septi nasi muscle on the tip in a lasting manner. For this, 5-0 clear nylon is used.

Tip Sutures

Interdomal Suture

Purpose. This suture is used to reduce the distance between the domes.

Indications. It is used when the domes are too far apart.

Technique. A 5-0 PDS suture is placed in such a manner that the knot will end up underneath the domes. This suture can be placed as a simple loop or in a figure-of-eight fashion. A loop stitch (Figure 6.1, Animation 6.1, Video 6.1) may overlap the domal cartilages, while the figure-of-eight suture will not only avoid this but, if the domes are overlapping or are misaligned cephalocaudally, will align them.

Animation 6.1 •

Video 6.1 •

Effects. While the main objective of this suture is to reduce the distance between divergent domes, depending on where the suture is placed, additional changes may be observed. If it is placed along the cephalic border of the domes, it may slightly rotate the lateral crura cephalically. If it is placed caudally, the effect will be reversed and it will rotate the lateral crura caudally. A suture that is placed in the center will merely reduce the distance between the domes without any rotation of the lateral crura. If the suture is passed further laterally along the anterior surface of the domes, as it is tied, it will borrow from the lateral crus and add to the central dome, thus gaining more tip projection and reducing the convexity of the lateral crus. The result is a more unified and commonly narrower tip. This variation of the interdomal suture only benefits patients who have a boxy, yet underprojected tip.

This suture, in addition to narrowing the interdomal distance, will strengthen the tip support, achieve more lobule volume, reduce the overall tip width and eliminate any clefting that may exist between the domes.

Transdomal Suture

Purpose. The goal is to reduce the width of the domal arch.

Indications. This suture is useful for patients with wide domal arches.

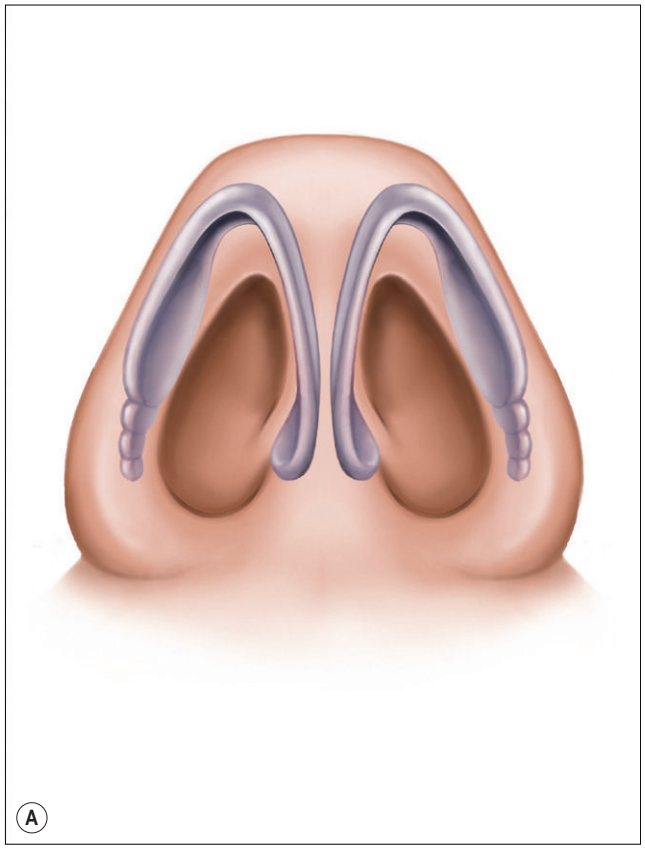
Techniques. Although a single suture can be passed across both domes and tied in the center, because there is commonly disparity in the thickness of the lower lateral cartilages and the domes, the thinner dome may respond to suture force more than the thicker dome, resulting in unequal narrowing. It is therefore preferable to place an independent transdomal suture across each dome. The suture is started from the medial aspect of one dome, passed across the dome without violating the lining and through the lateral portion of the dome, and then brought back across the dome and tied in the medial side of the dome (Figure 6.2, Animation 6.2, Video 6.2).

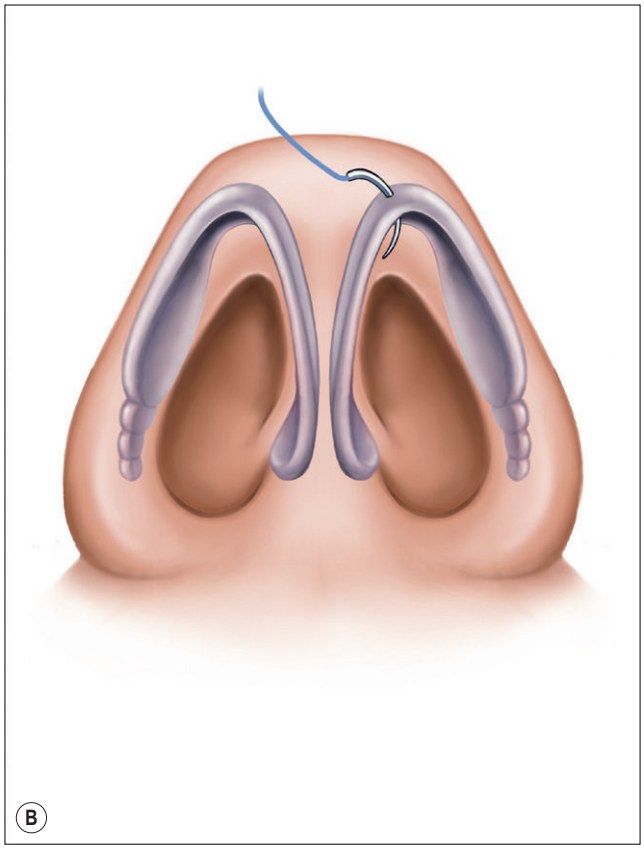
Animation 6.2 •

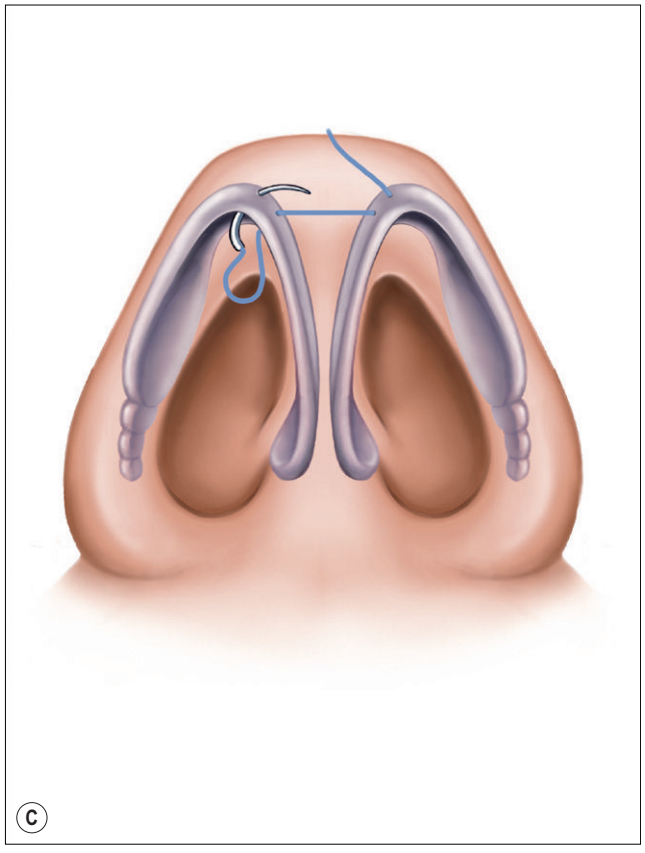
Video 6.2 •

Effects. Depending on where this suture is placed, the lateral crus may respond differently. If the suture is off center caudally, it will rotate the lateral crus caudally (Animation 6.2). If the suture is placed cephalically, it will rotate

Figure 6.1 A 5-0 PDS suture is placed in such a manner that the knot will end up underneath the dome.







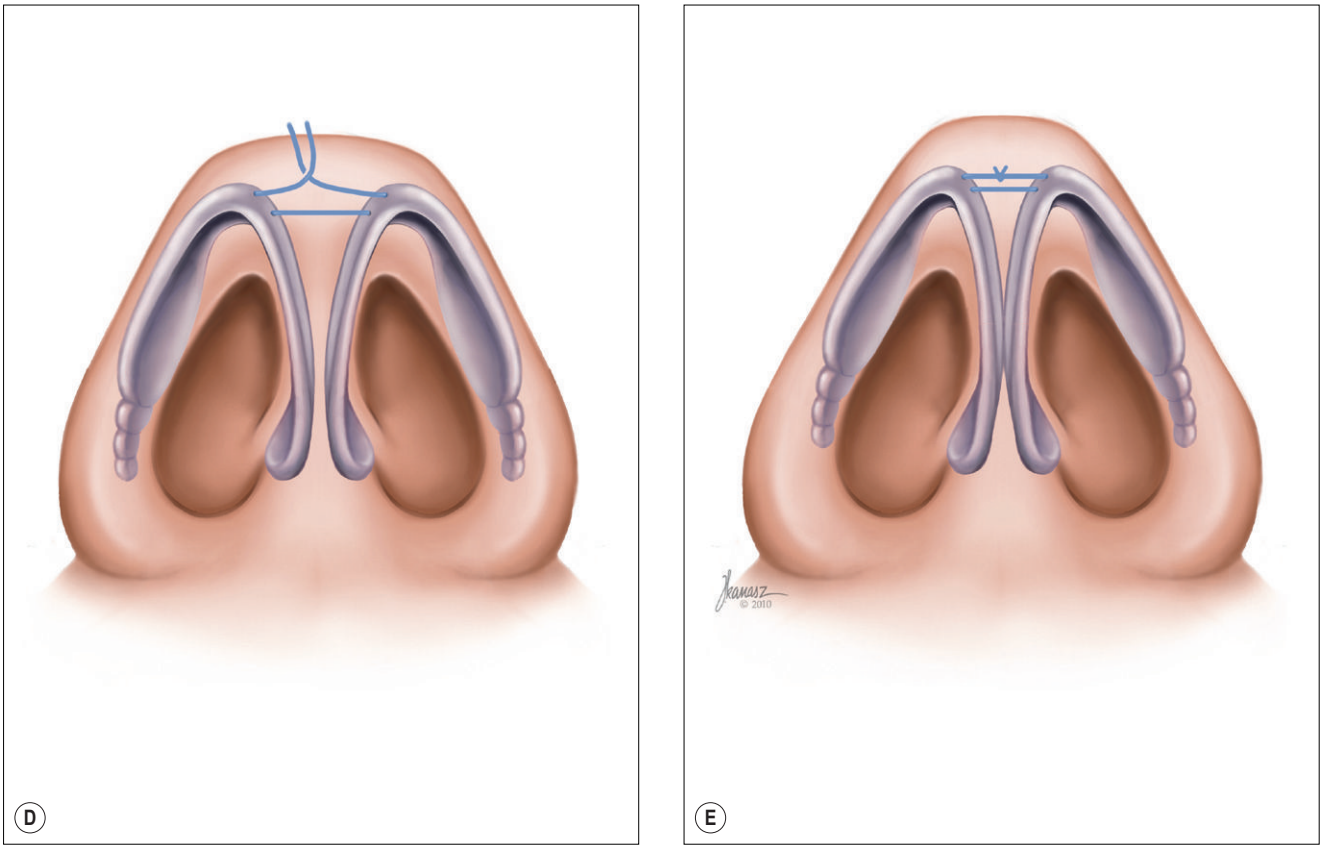


Figure 6.1, cont'd.

the lateral crus cephalically. A centrally positioned suture will reduce the domal width without rotation of the ala. In most cases, this suture will result in a slight cephalic retraction of the caudal border of the dome and thus retraction of the infratip lobule. The additional consequences of the transdomal suture are increased projection of the dome, flattening or concavity of the lateral crus and reduction in interdomal distance.

Middle Crura Suture

Purpose. This is to reduce the distance between the middle crura, unify the cental portion of the nasal tripod, and fix the columella strut.

Indications. This suture is useful for noses with weak tip support, a wide columella, and a wide angle of divergence between the middle crura.

Animation 6.3 •

Video 6.3 •

Technique. The suture can be placed on the cephalic, caudal margins or the mid-portion of the width of the middle crura (Figure 6.3, Animation 6.3, Video 6.3). The latter is preferable in most cases since it places the knot specifically in a position that can almost never be palpated. The suture is tied incrementally until a satisfactory distance between the middle crura and the domes is achieved. This generally sets the width of the dome from the lateral portion of one dome to the other side around 8–10 mm, depending on the thickness of the skin.

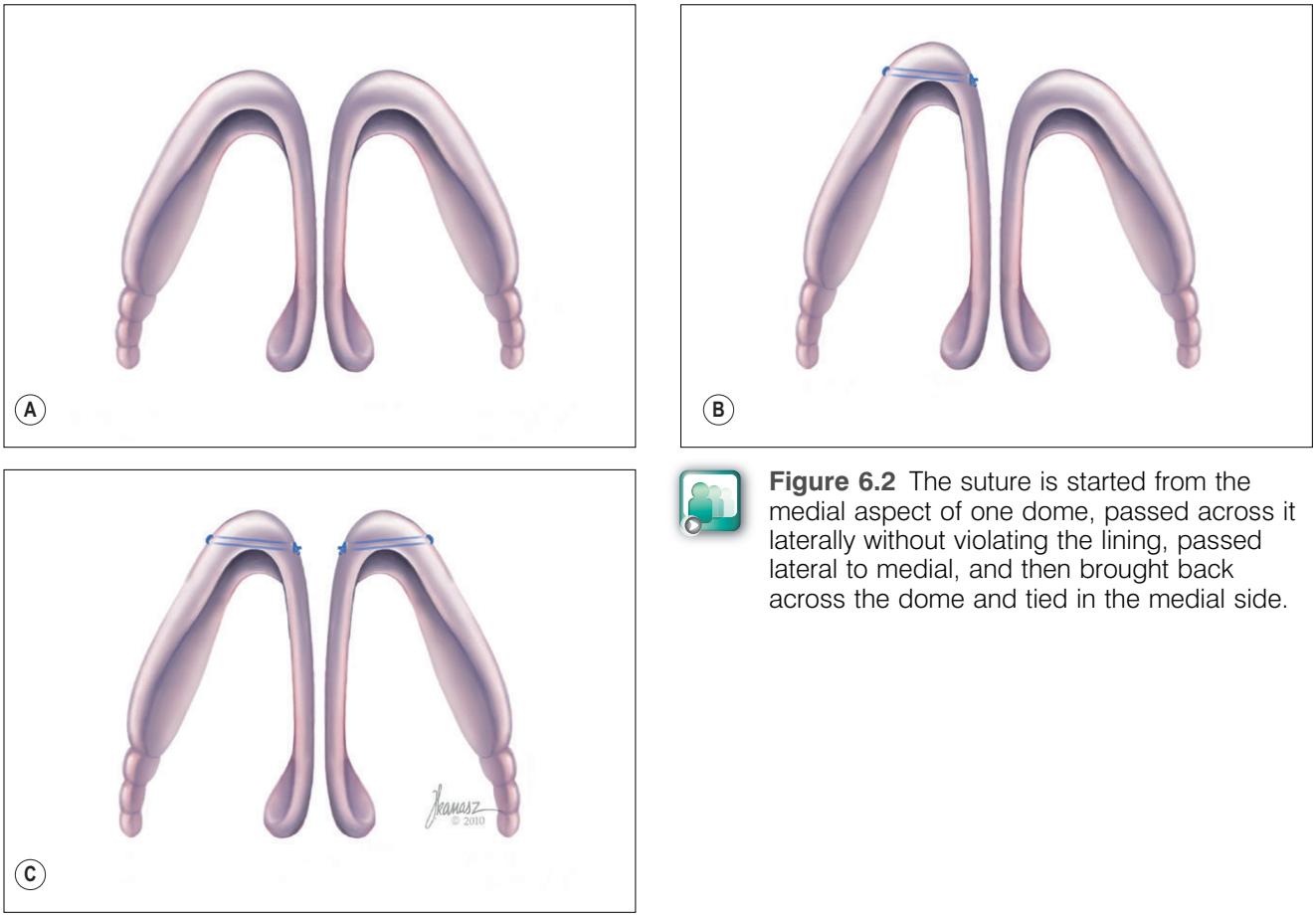
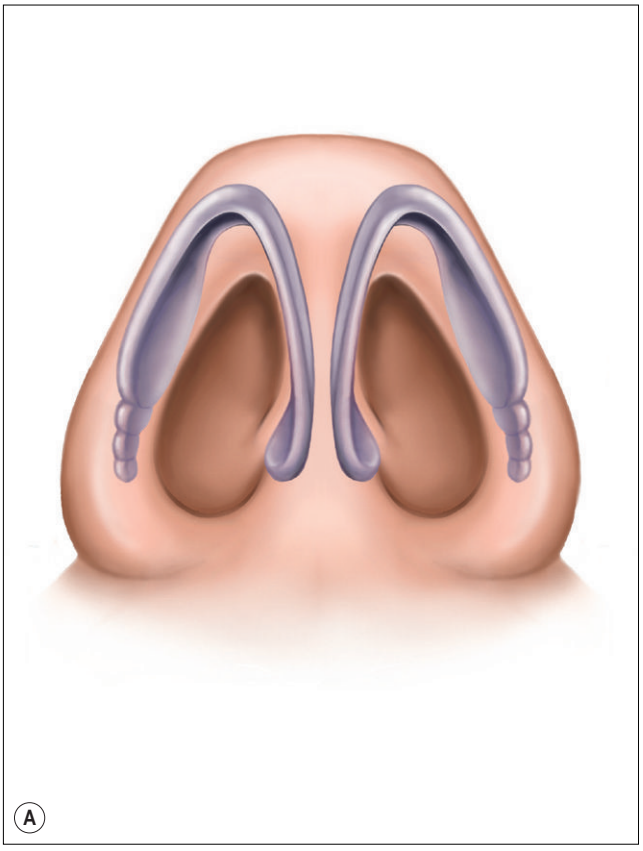
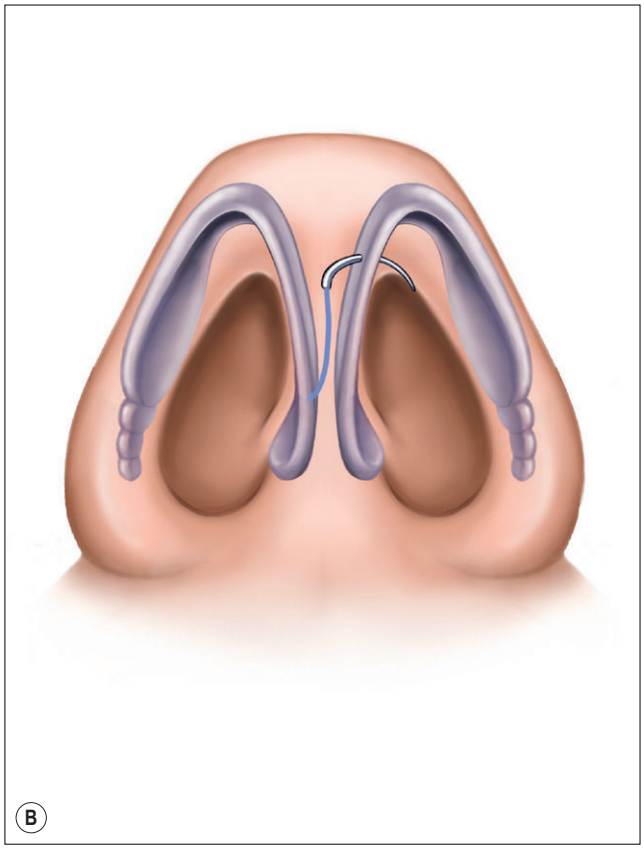


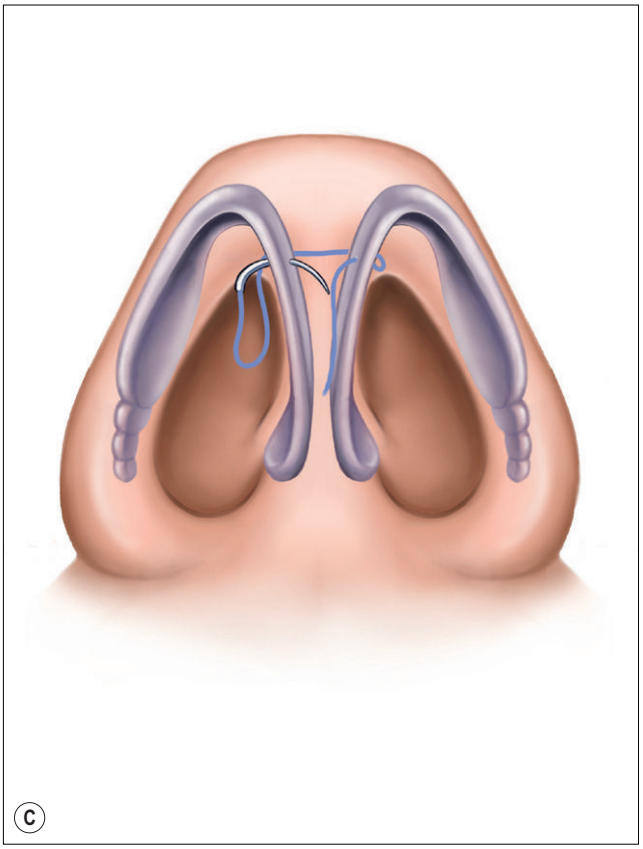
Figure 6.2 The suture is started from the medial aspect of one dome, passed across it laterally without violating the lining, passed lateral to medial, and then brought back across the dome and tied in the medial side.

Effects. The more anteriorly this suture is placed and the tighter it is tied, the greater the reduction in distance between the middle crura, and thus the narrower the tip becomes. The distance between the domes is reduced far less than with the interdomal and middle crura suture. The more anteriorly this suture is placed, the greater the effect on the interdomal distance. The middle crura suture increases the stability of the central portion of the nasal tripod and thus the tip support; it pushes the soft tissue anteriorly and results in more tip projection. It may also cause minimal caudal advancement of the infratip lobule due to medial rotation of the middle crura. Additionally, this suture rotates the anterior portion of the nostril more medially and widens the anterior portion of the nostrils by reducing the width of the columella. If this suture is placed along the caudal border of the middle crura, it will result in caudal rotation of the lateral crura. On the other hand, if it is placed in the cephalic margin of the middle crura, it may rotate the lateral crura cephalically to some degree.

Figure 6.3 The suture can be placed on the cephalic, caudal margins or the mid-portion of the width of the middle crura. Middle crus is the anterior portion of the medial crus.







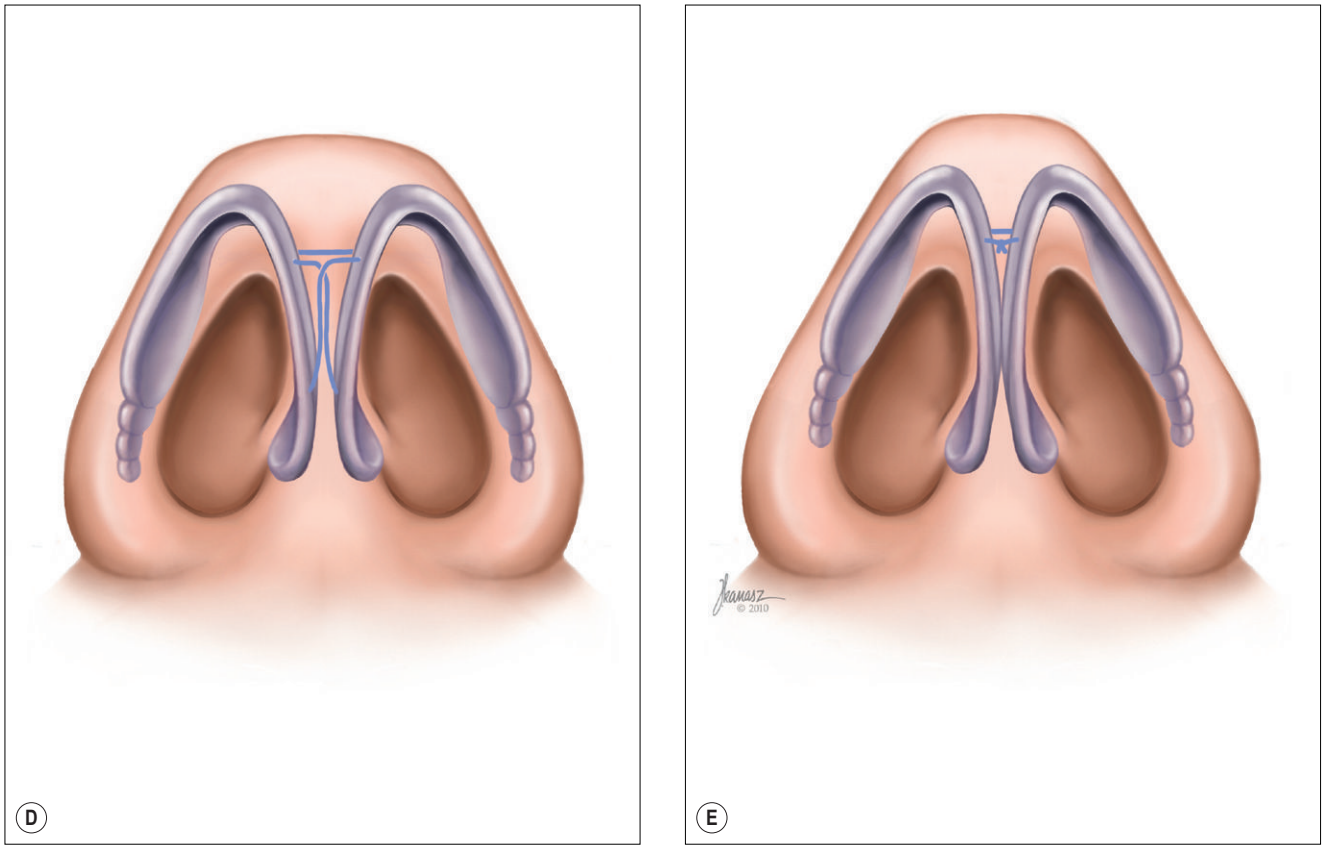


Figure 6.3, cont'd.

Anterior Medial Crura–Septal Anchor Suture

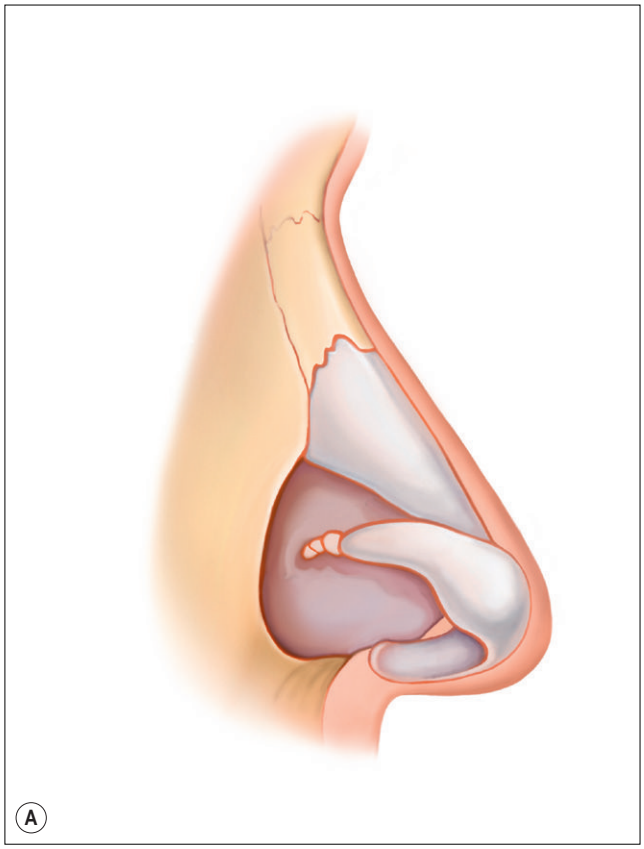
Purpose. The purpose of this suture is to suspend the medial crura from the anterocaudal septum to gain more tip projection.

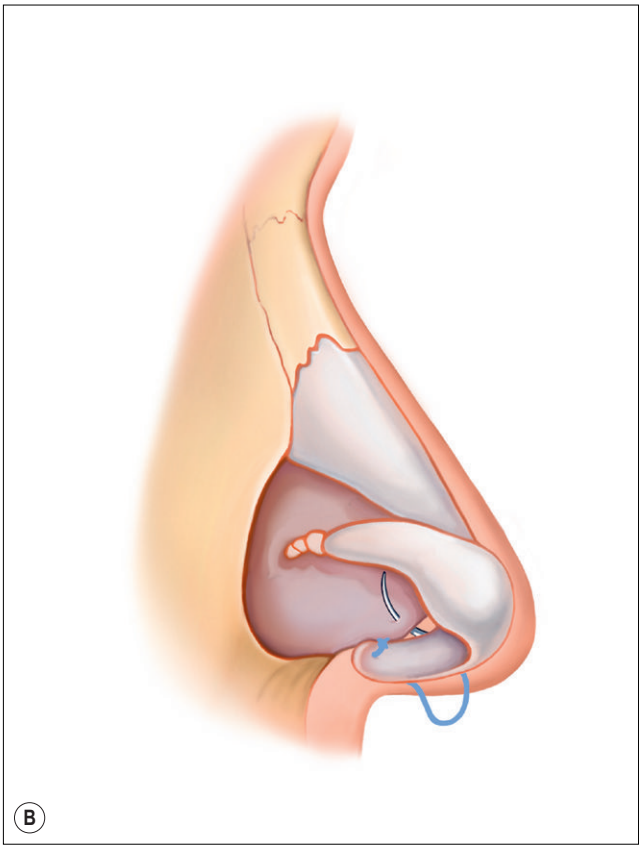
Indications. This suture is indicated on patients who have an underprojected tip with a short columella.

Technique. The medial crura or the footplates are minimally dissected through a transfixion incision (Figure 6.4, Animation 6.4, see Video 4.22b in Chapter 4). A 5-0 nylon suture is passed through the footplates or medial crura and tied gently. The same needle is passed through the anterocaudal septum. As the suture is tied incrementally, one can observe the repositioning of the entire basal unit anteriorly. It is important to tie the suture after it is passed through the footplates and before it is passed through the anterocaudal septum to avoid overlapping or separation of the footplates and riding on the caudal septum. The suture can also be placed directly between the cephalic portion of the medial crura and the caudal septum. However, its stability will not be as enduring.

Animation 6.4 •

Effects. As the suture is tied, the tip projection will increase, the domes will separate, and the tip becomes wide and rotates cephalically. This suture will also result in elongation of the columella and the nostrils.





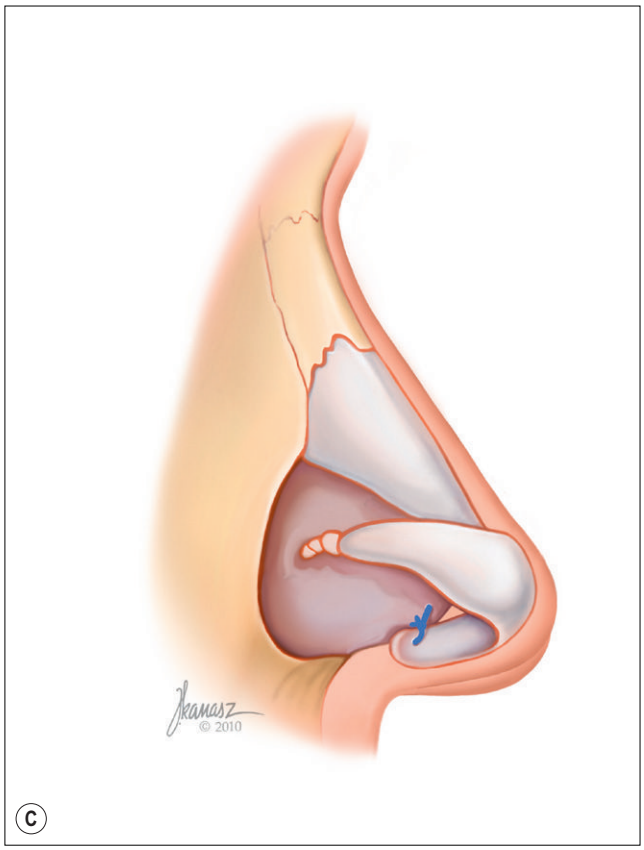


Figure 6.4 The medial crura or the footplates are minimally dissected through a transfixion incision. A 5-0 Nylon suture is passed through the medial crura and tied. The needle is then passed through the anterior portion of the caudal septum and tied incrementally. (See Video 4.22b in Chapter 4.)

Posterior Medial Crura–Septal Anchor Suture

Purpose. This suture is used to reposition the medial crura and footplates posteriorly.

Indications. This suture is indicated in patients who have an overprojected tip with a long columella.

Technique. The medial crura or the footplates are minimally dissected through a transfixion incision (Figure 6.5, Animation 6.5). A 5-0 nylon suture is passed through the footplates or medial crura and tied gently. The same needle is passed through the caudal septum posteriorly close to the anterior nasal spine. As the suture is tied, one can observe the repositioning of the entire basal unit posteriorly. Here as well, it is important to tie the suture after it is passed through the footplates to avoid overlapping or separation of the footplates and riding on the caudal septum.

Animation 6.5 •

Effects. As the suture is tied to pull the tip and columella posteriorly, the distance between the domes will become narrower and the tip will rotate caudally. This suture will also result in reduction of the columella length and shortening of the nostrils.

Tip Rotation Suture

Purpose. The goal of this suture is to approximate the cephalic margins of the middle crura to the anterocaudal septum and to widen the columellolabial angle.

Indications. This suture will best serve patients who have a long nose with a narrow columellolabial angle, especially those with an aging nose.

Technique. A 5-0 clear nylon suture is passed through the medial crura caudally (Figure 6.6, Animation 6.6, see Video 4.21c in Chapter 4) and tied along the caudal border of the medial crura. The suture will be started from the medial surface of one lateral crus and passed laterally. It travels about 4 mm and then is passed medially on the same side. The suture then traverses across the dorsum and is passed medial to lateral on the opposite lateral crus of the lower lateral cartilage. It is brought back in a parallel fashion symmetrically and tied incrementally while the assistant is controlling the knot with a pair of smooth forceps. The needle is then passed lateral to the medial crus on one side, through the anterocaudal septum, and back lateral to the medial crus on the opposite side, and tied incrementally while observing the repositioning of the tip cephalically. This rotation can be combined with increased projection if the suture is placed more posteriorly on the medial middle crura and more anteriorly on the anterocaudal septum, similar to the anterior medial crura anchor suture. This suture can also be placed between the cephalic margins of the middle crura and the anterocaudal septum.

Animation 6.6 •

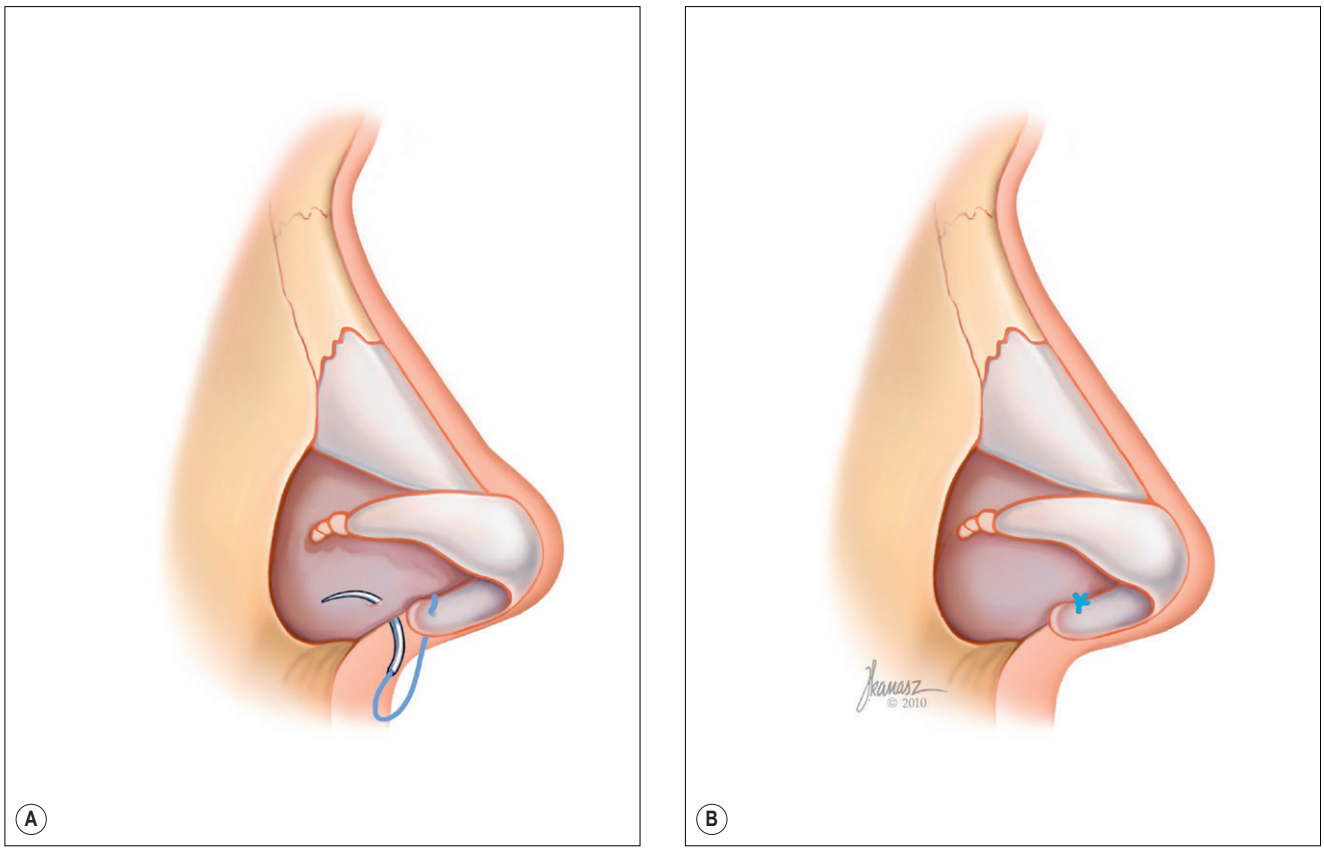


Figure 6.5 The medial crura or the footplates are minimally dissected. A suture is passed through the footplates and then tied gently. The suture is then passed through the posterior portion of the caudal septum and tied incrementally.

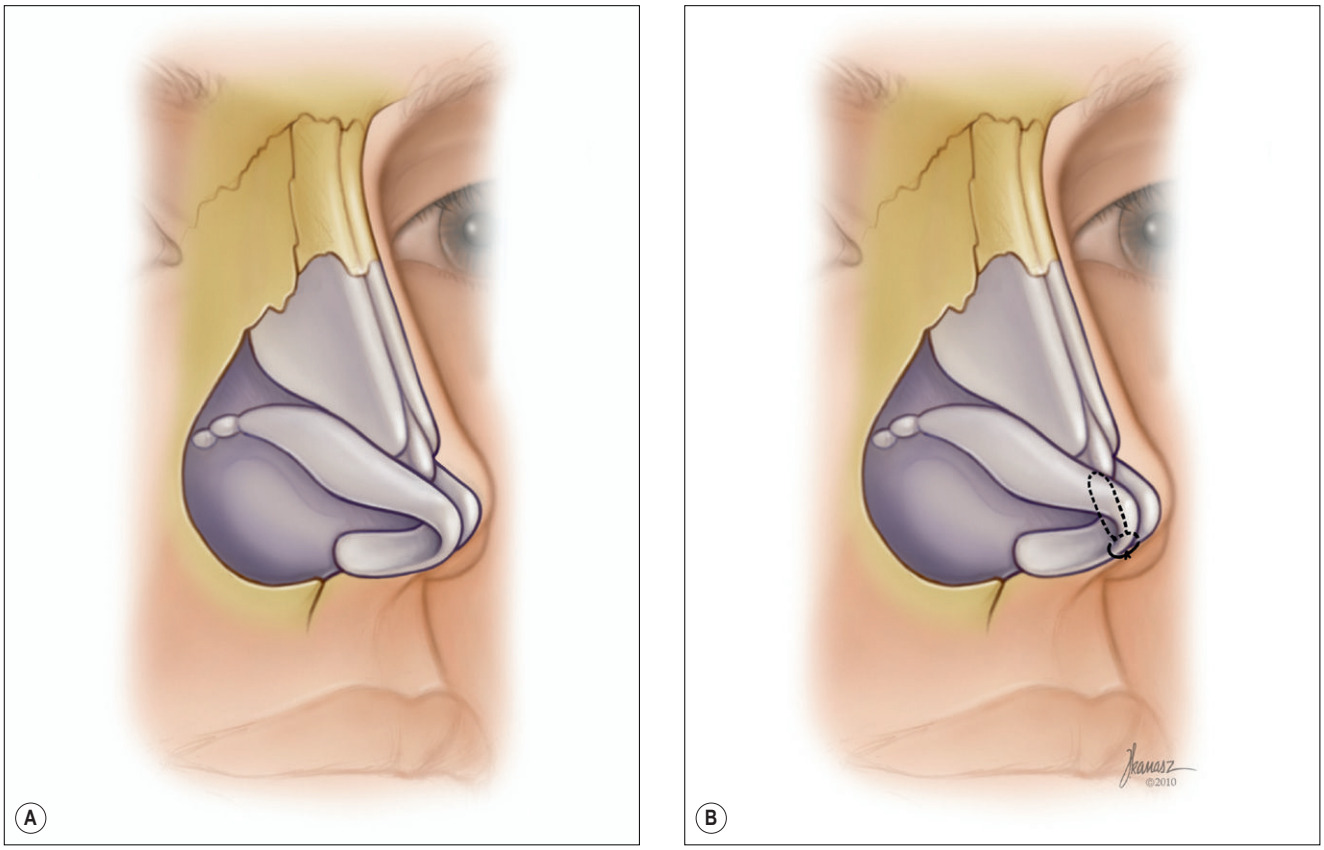


Figure 6.6 A 5-0 clear nylon suture is passed through the medial crura caudally and tied. The suture is then passed between the medial crus on one side and the columella strut, if it is used, passed through the anterocaudal septum, brought back to the opposite side medial crus and the columella strut and tied incrementally until adequate rotation is achieved. (See Video 4.21c in Chapter 4.)

Effects. This technique invariably results in slight retraction of the columella, which may or may not be part of the aesthetic goal. If the suture is passed through the cephalic margin of the middle crura without passing through the caudal portion, it may result in caudal separation of the middle crura and widening of the columella and the infratip lobule.

Lateral Crura Spanning Suture

Purpose. The aim of this suture is to reduce the convexity of the lower lateral cartilages.

Indications. This suture is useful for a patient who has convex lower lateral cartilages, especially when the nose is short.

Technique. This is a horizontal mattress suture. The suture will be started from the medial surface of one lateral crus and passed laterally. It travels about 4 mm and then passes medially on the same side. The suture then traverses across the dorsum and is passed medial to lateral on the opposite lateral crus of the lower lateral cartilage. It is brought back in a parallel fashion symmetrically and tied incrementally while the assistant is controlling the knot with a pair of smooth forceps to avoid overtightening (Figure 6.7, Animation 6.7, Video 6.4).

Animation 6.7 •

Video 6.4 •

Effects. While the main goal of the suture is to reduce convexity in the lower lateral cartilages, it also narrows the distance between the domes, retracts the ala and elongates the central portion of the nose. Depending on how far anterior or posterior the suture is placed, the dynamic effect will be different. A more anteriorly placed suture results in less retraction of the ala, more reduction in the interdomal distance and less effect on the convexity. A more posteriorly positioned suture causes less change in the distance between the domes, more retraction of the ala, and more dysfunction of the external valve.

Lateral Crus Convexity Suture

Purpose. This suture is designed to control the convexity or concavity of the lateral crus depending on how it is placed.[8] However, when the convexity is eliminated, the lateral crus will become longer and may push the tip caudally and anteriorly. This suture may also slightly advance the alar rim caudally.

Indications. This suture is used when the lower lateral cartilage is convex or concave.

Technique. To reduce the convexity, the suture is passed through at a right angle to the long axis of the lower lateral cartilage, incorporating at least 3 mm of the cartilage width anterocaudally (Figure 6.8, Animation 6.8). The

Animation 6.8 •

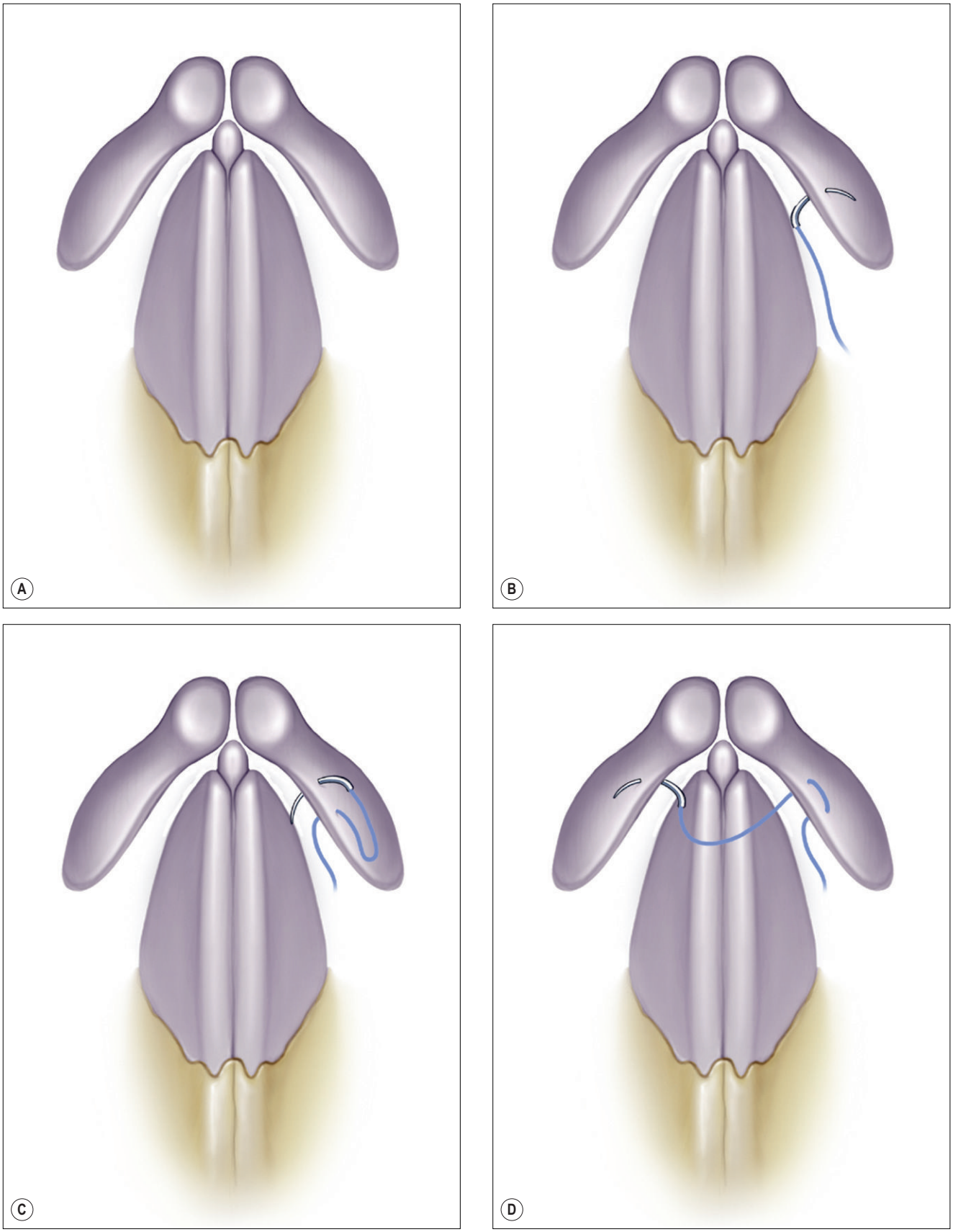
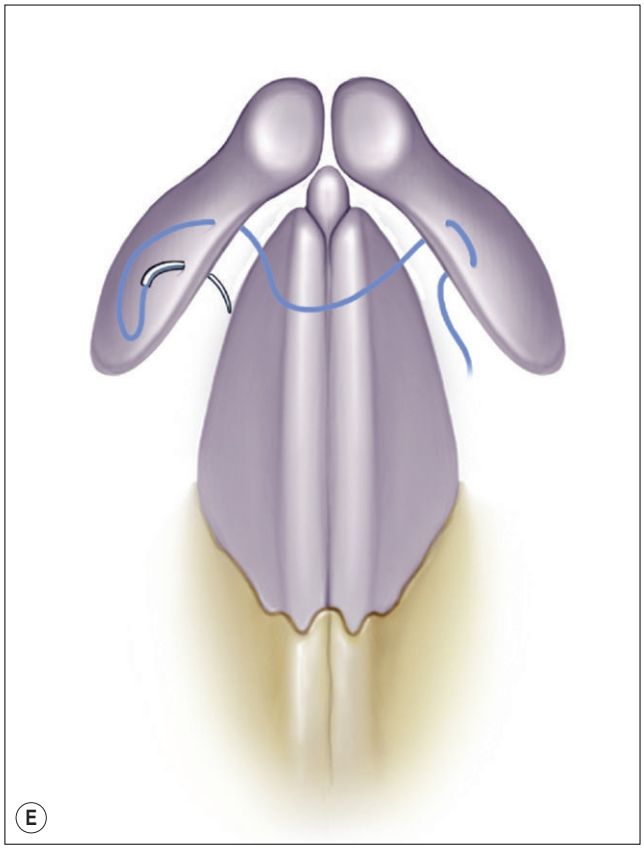
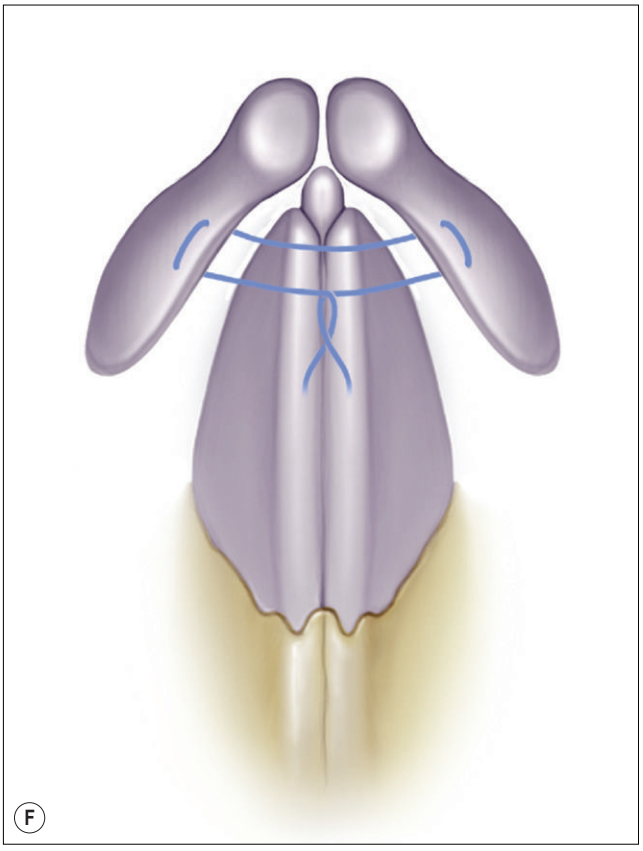


Figure 6.7 A horizontal mattress suture is started from the medial portion of one lateral crus, passed medial to lateral on one side, passed cephalically lateral to medial, crossed over the dorsum, passed through the opposite lower lateral cartilage, and brought back and tied incrementally while the assistant holds the knot with smooth forceps to avoid overtightening.





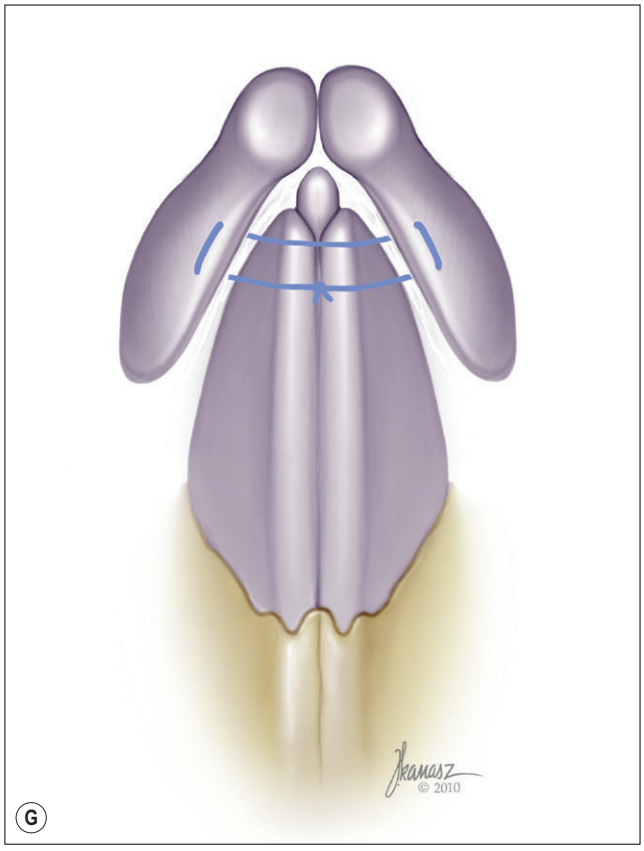


Figure 6.7, cont'd.

suture is then passed through the same cartilage about 6 mm posterocephalically in a mattress fashion. As the suture is tied, the convexity is monitored until the cartilage becomes straight. If the cartilage is concave, the same suture is used on the opposite surface.

Effects. This suture will also result in slight elongation of the nose. If it is inserted properly, it commonly adds to the strength of the lateral crura and provides better tip support. This suture also forces the area above the alar base laterally.

Medial Footplate Suture

Purpose. This suture narrows the base of the columella.

Indications. It is used when the footplates are divergent.

Technique. If a transfixion incision has been made, it will be utilized to place this suture. Otherwise, a 5 mm incision is made close to the footplates (Figure 6.9, Animation 6.9, see Video 4.22b in Chapter 4), each footplate is carefully exposed, and the redundant portion of the footplate is removed if the subnasale is optimal or only minimally retracted. If the subnasale is significantly retracted, the footplates are not trimmed. A 5-0 PDS suture is passed through the right footplate and a tunnel is created between the septum and the footplates using a pair of iris scissors. The opposite footplate is dissected and trimmed, if indicated, and the suture is delivered to the opposite side, the blunt end of the needle being passed first. The suture is passed through the left footplate and retrieved from the right side. As the footplates are approximated, the effects are observed for accuracy.

Animation 6.9 •

Effects. This suture creates more stability in the central portion of the nasal base tripod and also advances the subnasale caudally. It will also reduce the effectiveness of the depressor nasi septi muscle.

Complications of Suture Techniques

While extremely effective, suture techniques can result in complications or suboptimal results. Keen observation of the effects of the sutures during their placement is extremely important to prevent displeasing consequences. One of the most common adverse effects of suture techniques is excessive tip narrowing due to unification of the domes. This can happen without the use of an interdomal suture and can also result from placement of other sutures such as transdomal, lateral crura spanning, lateral crus convexity, and medial crura sutures. If this occurs, a subdomal graft[14] can be utilized to overcome the excessive narrowing of the interdomal distance.

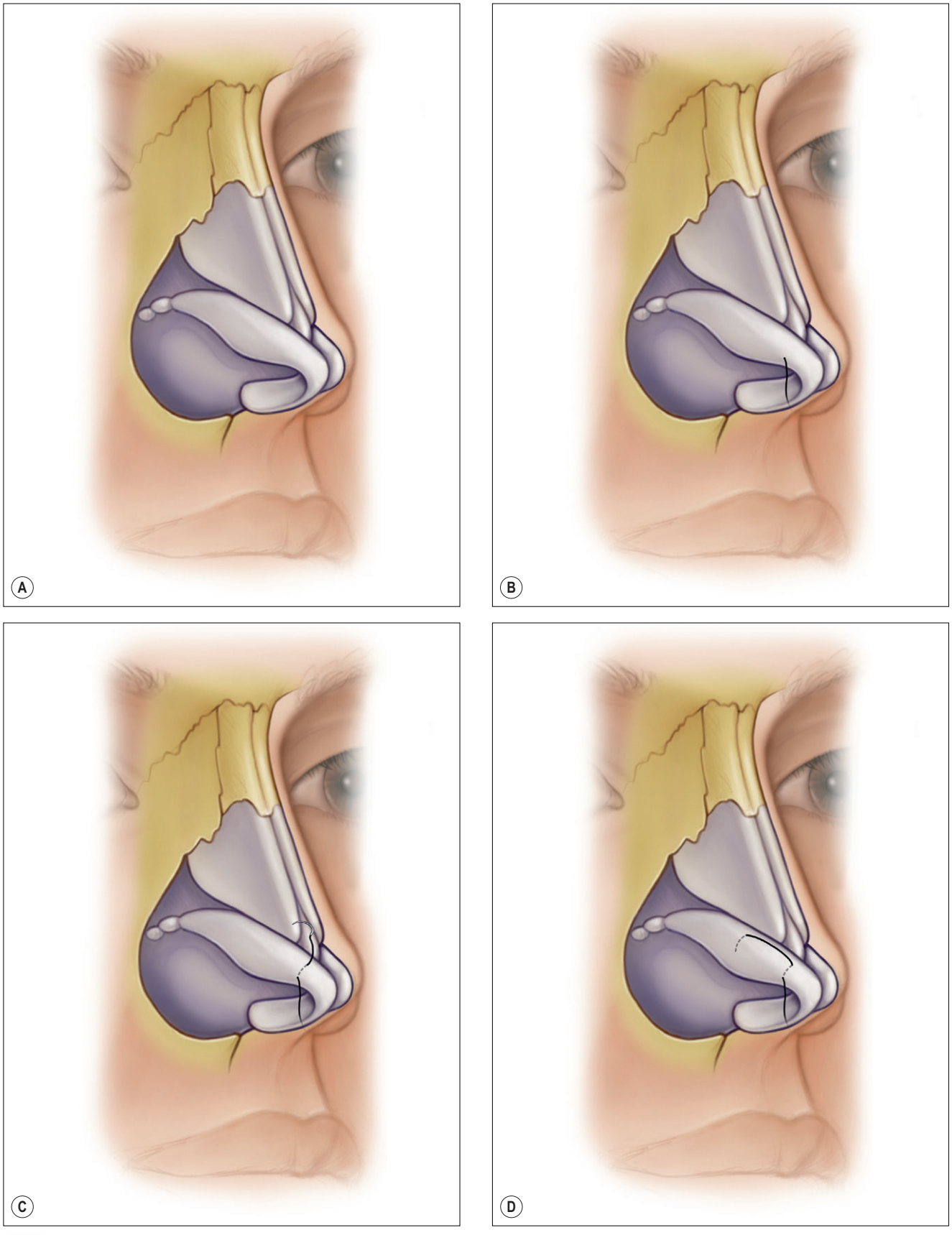


Figure 6.8 To reduce convexity, the suture is passed through at a right angle to the long axis of the lower lateral cartilage, incorporating at least 3 mm of the cartilage width anterocaudally.

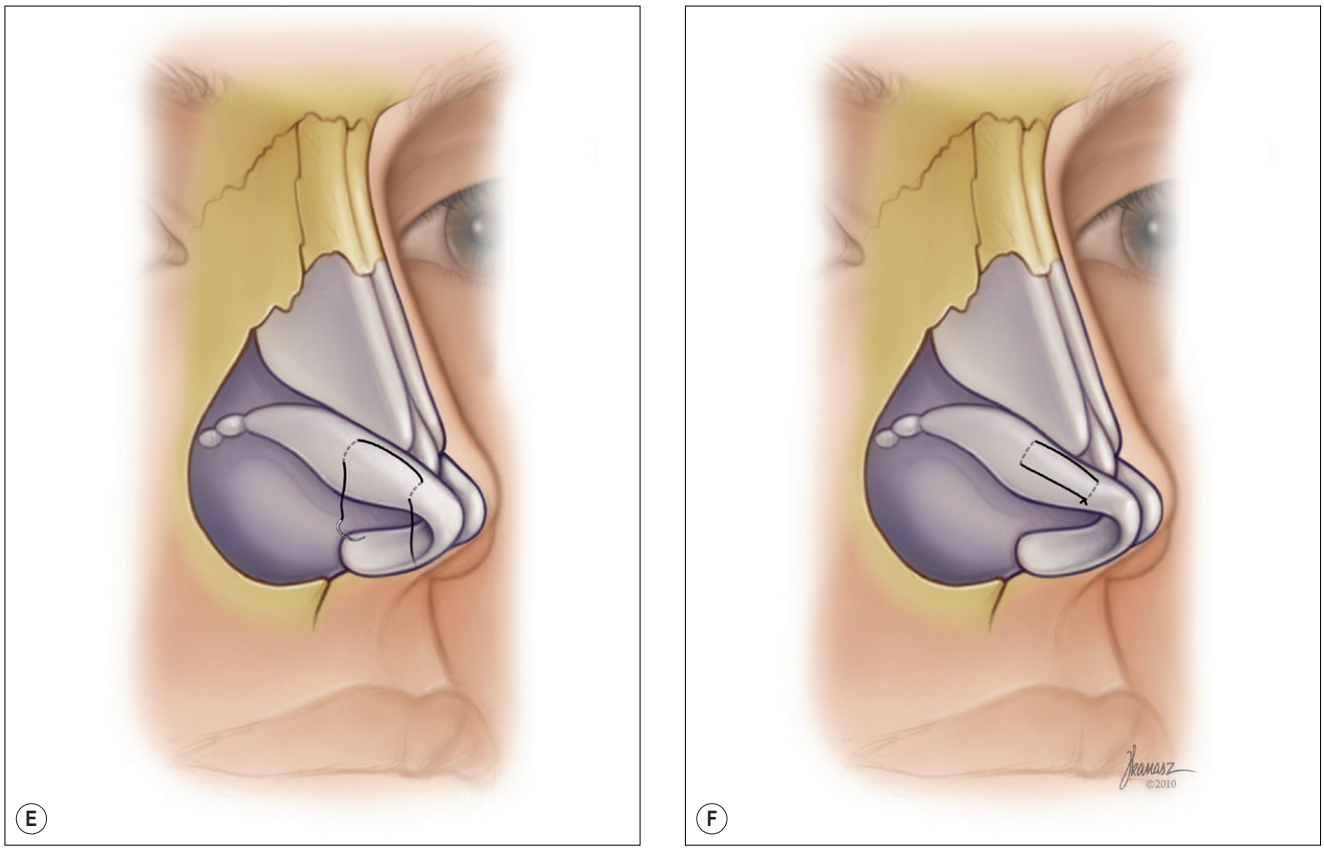


Figure 6.8, cont'd.

Another undesirable consequence of suture techniques is alar retraction. This can be reduced by careful observation and by insuring that the tightening of the sutures is only enough to serve the purpose without causing ill effects. However, even under the most ideal circumstances, alar retraction is a common possibility after cephalic trimming of the lower lateral cartilages, as well as after placement of some of the sutures as mentioned above. In order to overcome this displeasing effect, an alar rim graft can be placed in the majority of such noses. Other adverse events related to suture techniques include infection, rejection, and palpability. Infection is a highly unlikely complication and the use of absorbable sutures has further reduced the chance of late suture infection. As indicated earlier, suture-related infection is minimized with use of nonabsorbable sutures. Suture extrusion is unlikely and is usually the consequence of placing the suture too close to the skin or the nasal lining.

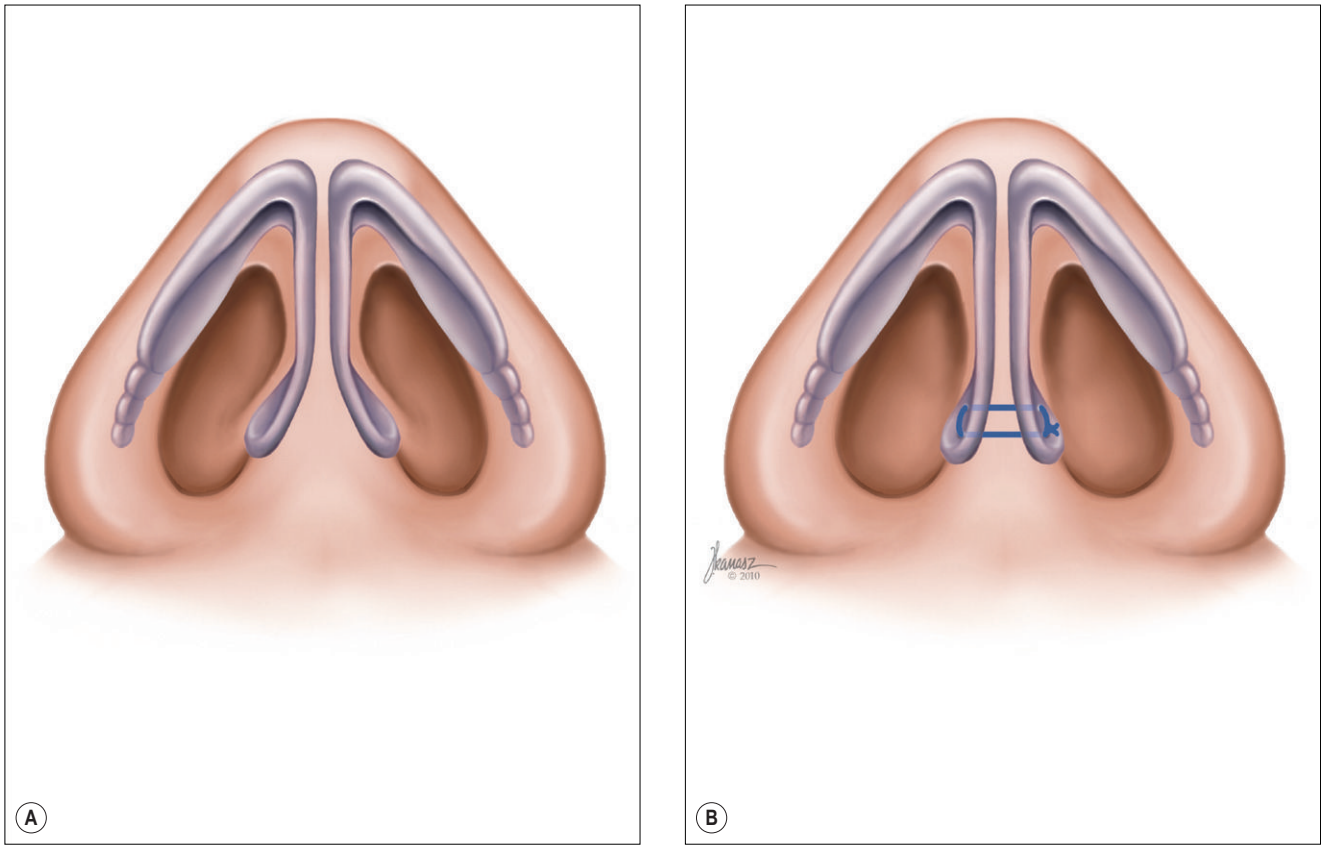


Figure 6.9 If a transfixion incision has been made, it will be utilized to place this suture. Otherwise, a 5 mm incision is made close to the footplates, each footplate is carefully exposed, and the redundant portion of the footplate is removed if the subnasale is optimal or only minimally retracted. (See Video 4.22b in Chapter 4.)

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Video 6.1 The interdomal suture can be placed as a simple stitch or in a figure-of-eight fashion. A simple stitch may overlap the domal cartilages, while the figure-of-eight suture will not only avoid this but, if the domes are overlapping or are misaligned cephalically, will align them.

Video 6.2 When a transdomal suture is utilized, it is preferable to place an independent transdomal suture across each dome to avoid asymmetry. The suture is started from the medial aspect of one dome, passed across the dome laterally without violating the lining, passed lateral to medial, and then brought back across the dome and tied in the medial side of the dome.

Video 6.3 To place a medial crura suture, a 5-0 PDS stitch is passed through the medial crus on one side, passed through the opposite side, and tied incrementally while watching the domes to ensure that they are not approximated too much.

Video 6.4 To place the Tebbetts lateral crura spanning suture, this horizontal mattress suture is started from the medial portion of one lateral crus, passing the suture medial to lateral on one side, passed cephalically lateral to medial, crossed over the dorsum. It is then passed through the opposite lower lateral cartilage and brought back. The suture is then tied incrementally while the assistant holds the knot with a pair of smooth forceps to avoid overtightening.

CHAPTER 7

Achieving Optimal Tip Projection

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Video Content

Animations

Pearls

- The nasal tip is the most important aesthetic unit of the nose and inadequate tip projection invariably results in failure of the rhinoplasty regardless of how harmonized the other parts are.

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- Inability to detect the pre-existing inadequate tip projection, some of the intraoperative maneuvers, and any postoperative changes can all result in inadequate tip projection.
- Whenever the anterocaudal septal angle is at the level of or more projected than the domes, it is very likely that the tip projection will be tangibly reduced following elimination of a dorsal hump.
- The tip support is reinforced through the use of a columella strut, a tip graft, suspension of the medial crura from the septum, or a combination of these.
- Removal of the cephalic margin of the lower lateral cartilages, a transfixion incision, reduction of the nasal spine, or lowering the caudal dorsal hump can result in reduction of tip projection.
- The different means of increasing tip projection have nuances and they cannot be used interchangeably. Each one must be used for a specific indication.
- The gain in tip projection related to the transdomal suture is associated with an increase in the infratip lobule volume.
- An onlay tip graft is indicated on a patient with insufficient infratip lobule volume and is contraindicated on a nose with excessive infratip lobule volume and a short columella.
- An onlay tip graft is not an optimal choice for a patient who has an underprojected, short nose. This patient would be a better candidate for a shield type graft.
- While the main goal of insertion of the subdomal graft is to control the distance between the domes and equalize their cephalocaudal position, this graft also lends more stability to the tip and adds to the tip definition and projection.
- A columella strut is utilized on a patient who has a short columella. This not only adds to the projection, it will result in lengthening of the columella, widening of the nasolabial angle, advancement of the subnasale caudally, and widening of the columella if a caudal medial crura suture is not used to control the width of the columella.
- A medial crura anchor suture is indicated on a patient who has a short columella. This not only results in elongation of the columella, it also rotates the tip cephalically, may widen the interdomal distance unless an interdomal suture is utilized, and may retract the columella slightly.
- It is important to unify the medial crura or insert a columella strut at the same time in order for the nasal spine and maxillary augmentation to have the greatest effectiveness on the tip projection,
- The Fred technique of advancement of the medial crura with the anterocaudal septum is suitable for the patient who has a significantly hanging columella.

The nasal tip is the most important aesthetic unit of the nose and its projection plays a cardinal role in tip definition and, thus, in the attractiveness of the nose. Inadequate tip projection invariably results in a failure of the rhinoplasty. Tip projection deficiency can be the consequence of an error in judgment or several maneuvers during a routine rhinoplasty. Perhaps the most common factor is failure to detect the pre-existing inadequacy of the tip-supporting structures. Additionally, a significant amount of tip projection can be lost due to intraoperative maneuvers that reduce the strength of the structures supporting the tip. Finally, postoperative changes may result in the loss of some of the tip support.

The patient in Figure 7.1 appears to have an overprojected tip. However, in reality, the tip is suspended from the anterocaudal dorsum. As the caudal dorsum is lowered to eliminate the dorsal hump, the tip support will be reduced substantially. This type of perceived overprojection of the tip can be differentiated from a true overprojection by palpation of the tip and supratip structures. Whenever the anterocaudal septal angle is at the level of or more projected than the domes, it is very likely that the tip projection will be tangibly reduced following elimination of the dorsal hump. The caudal

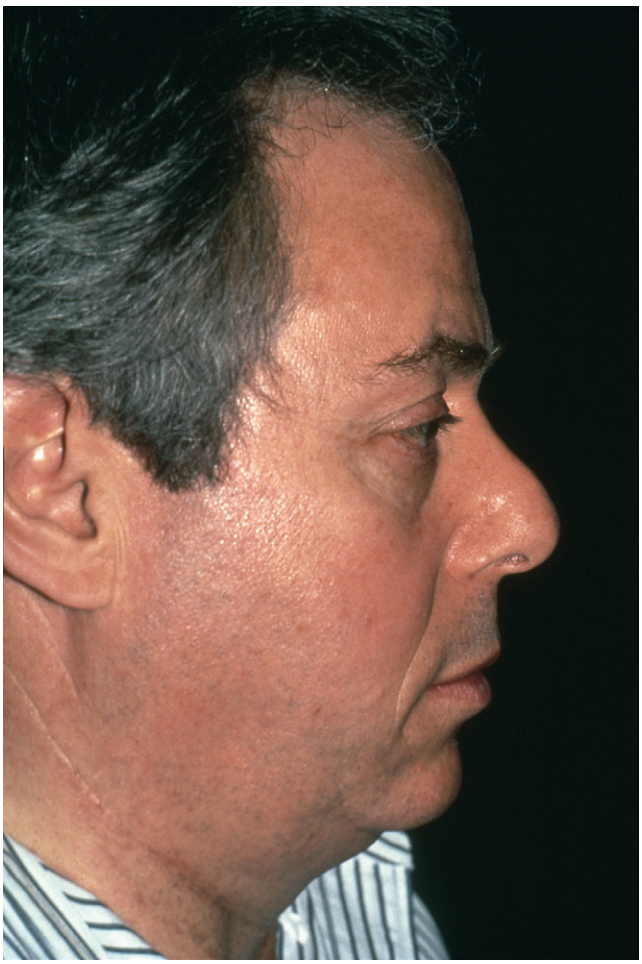


Figure 7.1 Lateral view of a patient demonstrating significant supratip overprojection ostensibly causing overprojection of the tip. However, reduction of the caudal septal projection will result in significant loss of tip projection on this patient.

portion of the nasal tripod (see Chapter 9) is weaker than the lateral limbs and the caudal septum plays a supreme role in the stability of this part of the tripod. To maintain or improve the tip projection in such cases, one must augment the support of the central structures if the caudal dorsum is to be lowered, unless the tip is truly and significantly overprojected. The tip support is reinforced through the use of a columella strut, a tip graft, suspension of the medial crura from the septum, or a combination of these, after consideration of the other factors that will be discussed below.

As discussed in Chapter 3, many intraoperative maneuvers result in the loss of tip projection. Removal of the cephalic margin of the lower lateral cartilages can minimally reduce the tip projection in patients with a cephalic orientation of the lower lateral cartilages. A transfixion incision, by virtue of releasing the attaching fibers of the medial crura to the caudal septum, can result in the loss of tip projection, as can reduction of the nasal spine, by lowering the supporting platform for the footplates. Interruption of the lateral or medial crura, or even simply the use of the open approach, can result in the loss of tip projection.[1] However, one of the maneuvers that reduces tip projection most strongly is lowering of the caudal dorsum, as mentioned above.

A transfixion incision, in addition to the intraoperative elimination of supporting fibrous bands, may decrease tip projection because of scar contracture postoperatively. Loss of the supporting grafts or release of suspension sutures can reduce tip support, which commonly produces a supratip deformity long after surgery.

Prevention of the loss of tip projection requires a circumspect analysis of the structures surrounding the nose, prudent consideration of the intraoperative maneuvers that may result in weakening of the elements maintaining tip position, and implementation of maneuvers that will ultimately restore a sufficient, stable foundation to the central limb of the tripod, which sustains the tip.

The means available to increase or restore tip position are listed in Box 7.1. Each of these maneuvers has specific indications and consequences and they often cannot be used interchangeably. It is therefore absolutely crucial to understand what type of augmentation should be used when, and to be cognizant of the potential changes. While some of these have been discussed in Chapter 3, the magnitude of the role that the tip plays in rhinoplasty and the part these maneuvers play in tip definition makes review of these items worthwhile.

Transdomal Suture

As discussed in Chapters 3 and 6, this suture adds to the tip projection by borrowing from the lateral crus. It narrows the horizontal portion of the

BOX 7.1

Maneuvers Used to Increase Tip Projection

- Transdomal suture
- Onlay graft
- Shield graft
- Subdomal graft
- Columella strut
- Medial crura suture
- Medial crura anchor suture to the anterocaudal septum
- Approximation of footplates
- Nasal spine and maxillary augmentation
- Fred technique

domes and boosts the vertical dimension of the dome. The gain in tip projection comes at the expense of extra infratip lobule volume. This may or may not be beneficial to the balance of the nose. One may have to resort to the maneuvers discussed in Chapter 13 to maintain or provide equilibrium between infratip lobule length and nostril size. In addition to the gain in projection inherent in narrowing the domes, by virtue of providing more rigidity to the dome, this suture invariably makes the tip structures more effective by not yielding under the tension induced by the overlying skin (see Figure 6.2; Animation 6.2 in Chapter 6). This suture may add as much as 1–2 mm to the projection, depending on the previous width of the dome, and commonly results in some concavity of the lateral crus, requiring an alar rim graft to avoid a cloverleaf-type deformity. In a wide underprojected tip, particularly when the infratip lobule is inadequate, this suture can be highly beneficial (Figure 7.2).

Onlay Tip Graft

This graft can provide a variable amount of tip projection depending on its thickness, the number of layers of cartilage used and the stability of the structures under the graft. It invariably increases the infratip lobule volume. It is therefore suitable only for patients who have insufficient infratip lobule volume and is contraindicated in a nose with excessive infratip lobule volume and a short columella. Depending on how narrow the graft is, it may provide the optical illusion of a narrower tip. Furthermore, depending on where it is placed over the underlying domes, this graft may provide the impression of cephalic rotation of the tip. The further cephalic the graft is placed over the domes, the greater the appearance of cephalic rotation it will generate. Thus,

Figure 7.2 Basilar view demonstrating the projection gained from narrowing wide domal arches.

an onlay tip graft may not be optimal for someone who has a short nose. On the other hand, this graft is appropriate for a patient who has inadequate infratip lobule volume and a narrow nasolabial angle. It is commonly used in conjunction with other techniques that enhance tip projection. It can be inserted using either a closed or an open technique.

Video 7.1 • 7.2 • 7.3

Animation 7.1 •

The graft is harvested using a tip graft punch[2] (Video 7.1) from a piece of septal or conchal cartilage. The harvested graft is retrieved (Video 7.2), sutured in position (Video 7.3) using 6-0 polyglactin, and observed three-dimensionally for perfect symmetry (Figure 7.3; Animation 7.1). In patients with thinner skin, the graft may be gently bruised to minimize the visibility of its outline (Figure 7.4) and prevent harsh definition of the graft. In all patients, the margins of the graft are beveled to provide a more natural transition from the tip to the alar area. A shield graft would achieve the same result, in addition to advancing the infratip lobule caudally (Box 7.2).

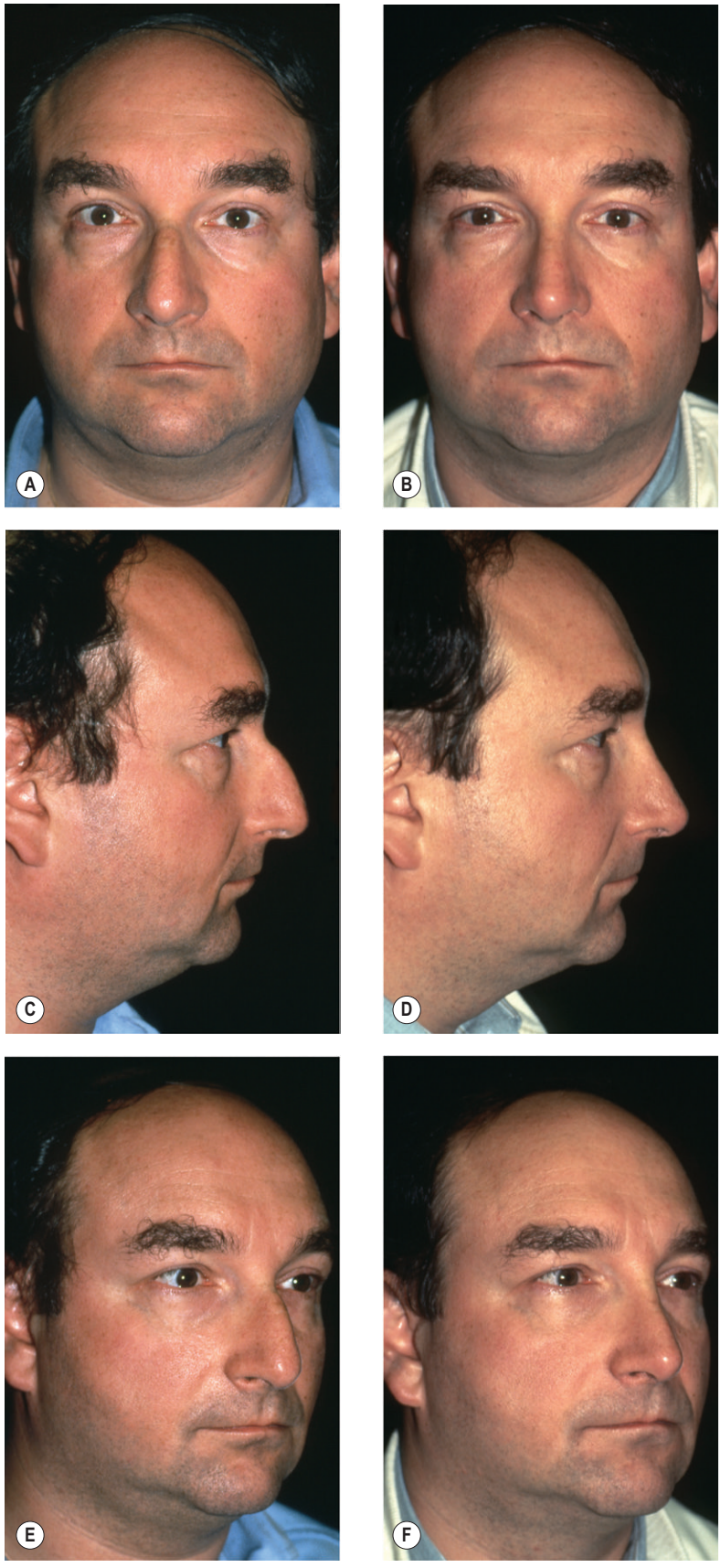
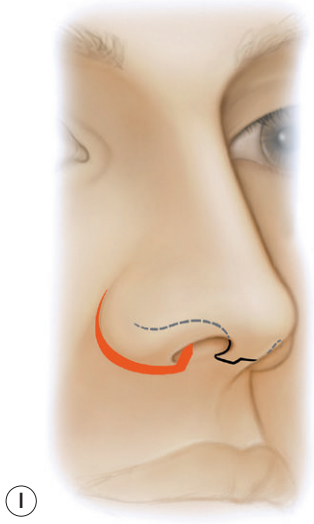


Figure 7.3 Standard views of a patient before (A, C, E, G) and after (B, D, F, H) insertion of a tip graft in a patient who ostensibly has an overprojected tip. Graphic illustration of the soft tissue and skeletal alterations (I, J).



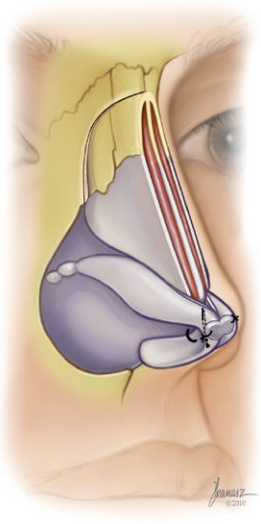


Figure 7.3, cont'd.

BOX 7.2

Surgical Steps: Figure 7.3

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A low-to-low osteotomy was carried out bilaterally
- Bilateral medial osteotomies were carried out
- Bilateral lateral osteotomies were carried out
- The medial crura were approximated
- Transdomal sutures were placed
- An onlay tip graft was applied
- The anterior caudal septum was resected as a wedge, with a proportional amount of membranous septum
- The alar bases were narrowed bilaterally using combined excision

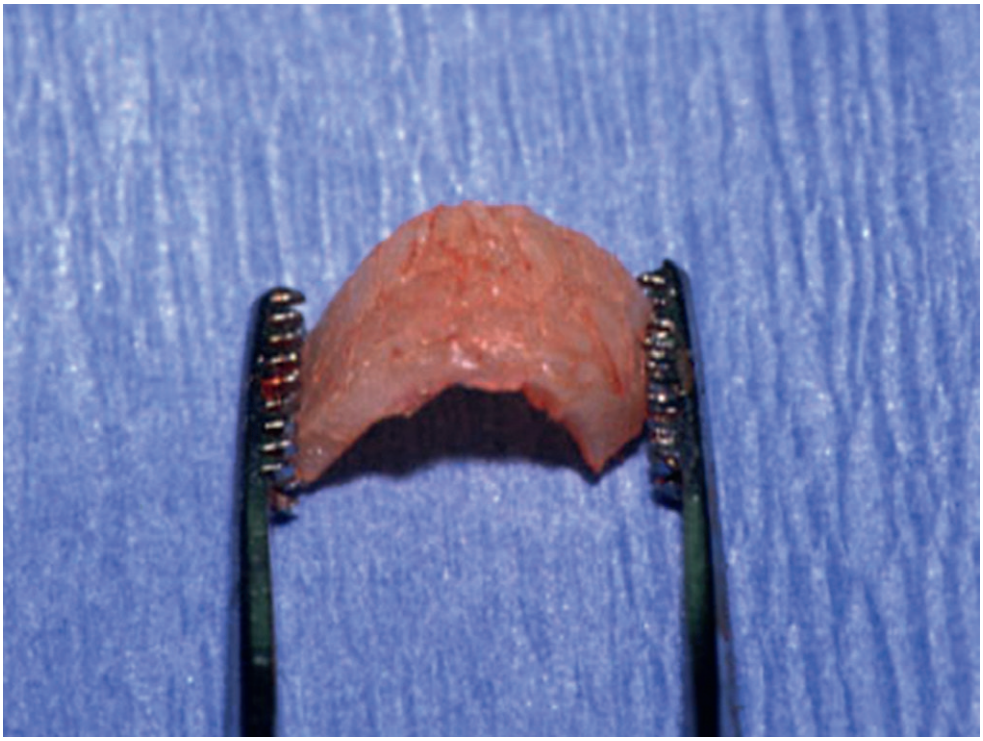


Figure 7.4 To minimize the visibility of the graft in patients with thinner skin, the cartilage graft is gently crushed to eliminate the harshness in appearance.

Subdomal Graft

While the main goal of insertion of a subdomal graft is to control the distance between the domes and equalize their cephalocaudal position, this graft also lends more stability to the tip and adds to the tip definition and projection.[3]

A 10 mm long bar of cartilage with a thickness of about 1.5 mm and a width of 1.5 mm is carved. A tunnel is created under both domes and the cartilage bar is inserted under one dome, advanced under the other, and sutured in place using 6-0 polyglactin sutures passing through each dome. A third suture is placed between the domes to set the optimal interdomal distance.

Columella Strut

A properly designed columella strut can result in greater tip projection, lengthening of the columella, widening of the nasolabial angle, advancement of the subnasale caudally, and widening of the columella, especially if the

medial crura are not approximated properly. This widening of the columella can be avoided by placing the columella strut slightly cephalad to the caudal border of the medial crura and by the use of 5-0 PDS sutures to approximate the medial crura. A columella strut is used when the columella is short and tip support is inadequate in a patient who has a narrow nasolabial angle and retracted subnasale (Figure 7.5; Animation 7.2; Box 7.3). It is important to avoid close contact between the columella strut and the underlying nasal spine, which can result in a side-to-side shift of the columella and cause clicking when the tip is moved. The posterior end of the columella strut should be rounded to facilitate easy gliding without clicking. Alternatively, the posterior end of the columella strut can be fixed to the underlying structures with a 5-0 nylon suture to avoid shifting or clicking. The technique of insertion of the columella strut has been discussed in detail in Chapter 4.

Animation 7.2 •

Medial Crura Anchor Suture

As was discussed in Chapter 6, a simple and routine medial crura suture can improve the tip projection by stabilizing the medial limb of the nasal tripod. This suture can provide a significant increase in tip projection, elongate the columella, and widen the nasolabial angle. As the anchor suture is tightened, the domes may separate unless an interdomal suture has been placed first. The medial crura anchor suture is, therefore, indicated in a patient with a slightly hanging, short columella and a narrow nasolabial angle, or one with significantly deficient tip projection.

Approximation of Footplates

This maneuver offers minimal additional projection by providing more stability to the central portion of the nasal tripod. It also narrows the columella base, advances the subnasale caudally, and lengthens the columella. It is therefore appropriate for a patient with a wide columella base, inadequate tip projection, and retracted subnasale.

Maxillary and Nasal Spine Augmentation

Although there is an invariable gain in tip projection from maxillary and nasal spine augmentation, the magnitude of the change is unpredictable. It depends on the quality of the support structures in the central portion of the nasal tripod. If a columella strut is placed and the central limb of the nasal tripod is strengthened, more of the advancement of the nasal spine and anterior maxilla will be transmitted to the tip. However, if the medial crura are weak, advancement of the nasal spine and anterior maxilla may result in a partial

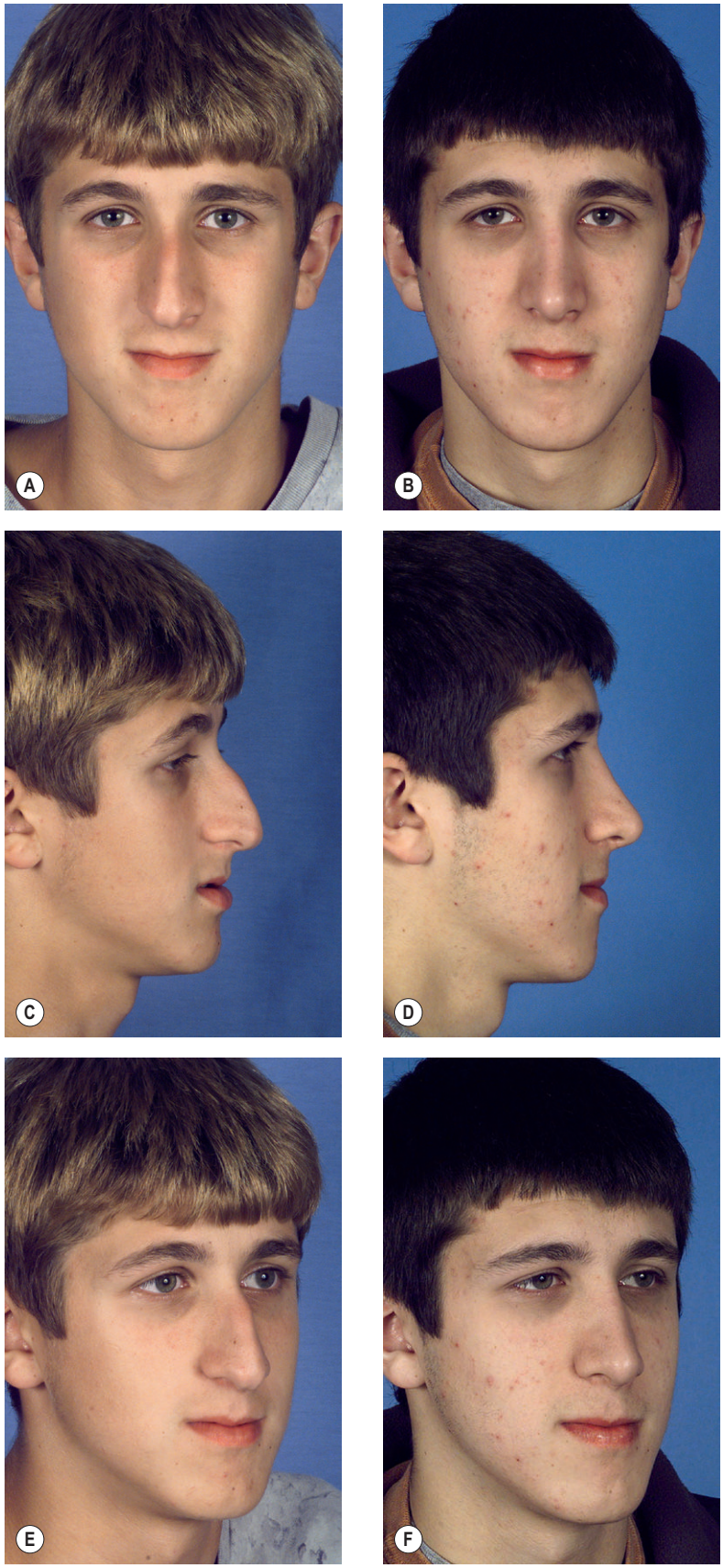
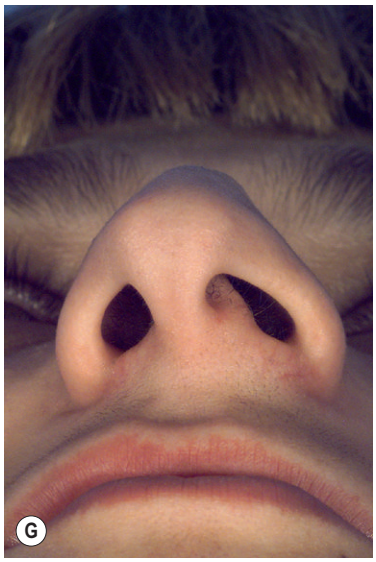
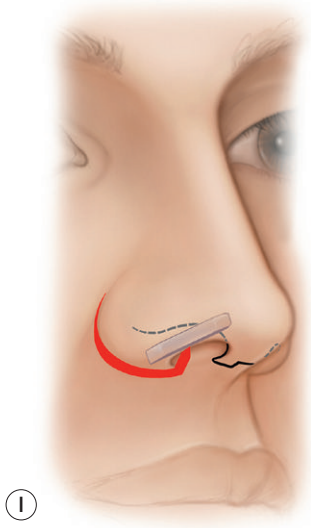


Figure 7.5 A patient with a significantly short columella and inadequate tip projection before (A, C, E, G) and 16 months after (B, D, F, H) placement of a columella strut along with other maneuvers detailed in the illustrations of the soft tissue (I) and skeletal alterations (J).





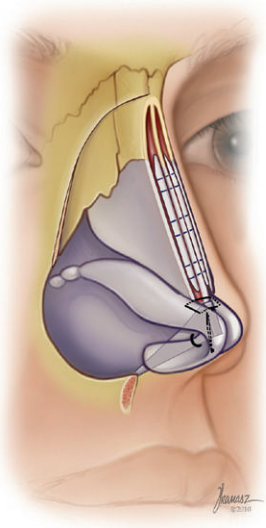


Figure 7.5, cont'd.

BOX 7.3

Surgical Steps: Figure 7.5

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was performed
- A low-to-low osteotomy was carried out bilaterally
- Bilateral spreader grafts were applied
- A columella strut was applied
- The medial crura were approximated
- Transdomal sutures were placed
- A lateral crura stitch was placed
- An onlay tip graft was applied
- The posterior caudal septum was resected as a wedge, with a proportional amount of membranous septum
- The nasal spine was reduced
- The alar bases were narrowed bilaterally using combined excision
- Bilateral alar rim grafts were applied

gain in tip projection and partial buckling of the medial crura and flattening of the footplates. Nasal spine or premaxillary augmentation is beneficial for a patient with a deficiency in these sites, a narrow nasolabial angle, and an underprojected tip. An isolated nasal spine augmentation is commonly performed through a small transfixion incision. A subperiosteal pocket is created by dissection between the footplates that extend down to the premaxillary area. This is the most forgiving part of the nose and diced or solid blocks of cartilage, which are not useful anywhere else, can be used in this site. Because of the significant thickness of the overlying soft tissues, one does not need to be too concerned about the quality of the cartilage utilized here. This does not mean, however, that the amount or the shape of the cartilage can be selected carelessly. Generally, this should be the last area to be grafted. It is important to approximate the footplates anterior to the graft to give more stability to the central portion of the nasal tripod.

Fred Technique

Using this technique[4] the footplates and medial crura are separated from each other, advanced over the caudal portion of the septum, and fixed in a more anterior position if an increase in tip projection is required (Figure 7.6;

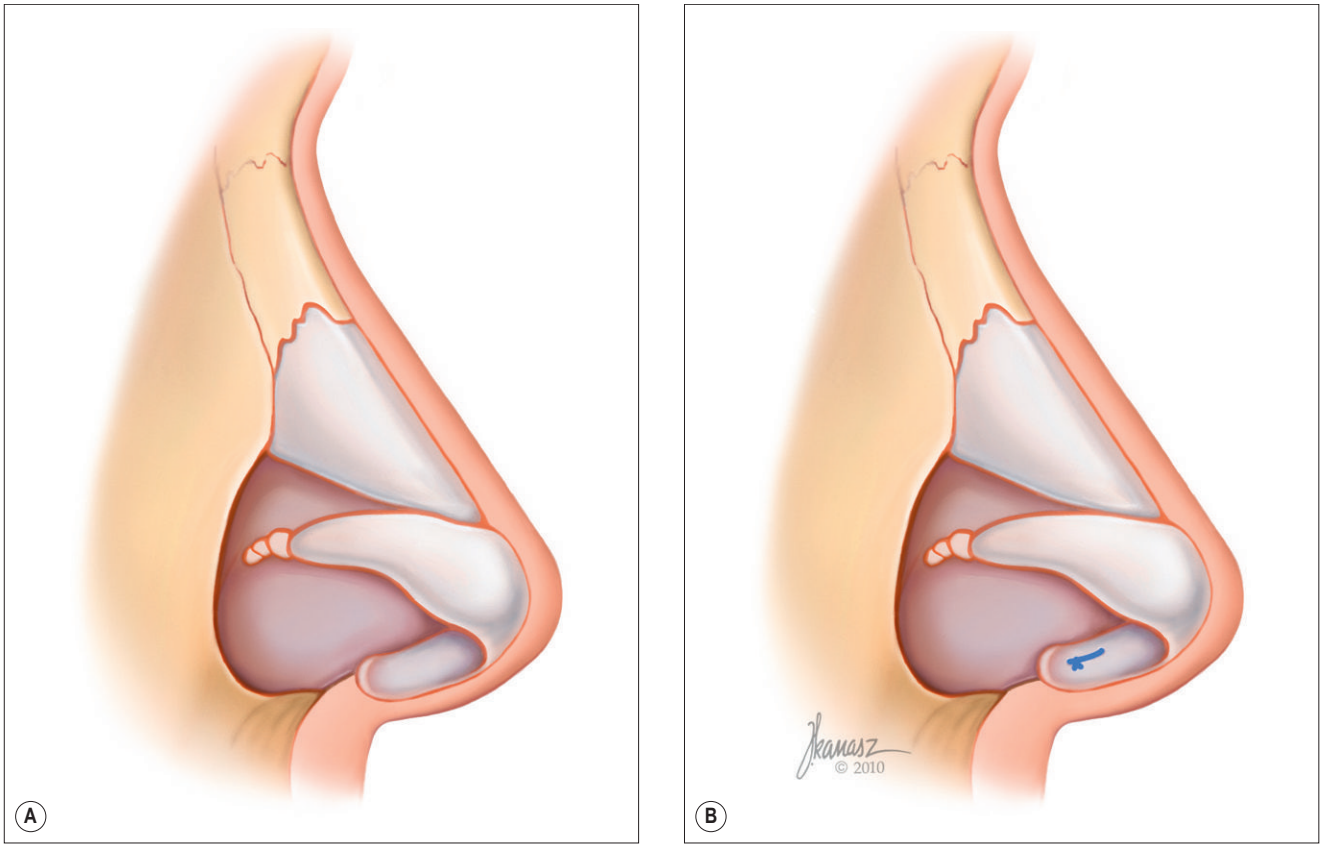


Figure 7.6 The Fred technique. The medial crura are separated and advanced over the septum and sutured to the septum.

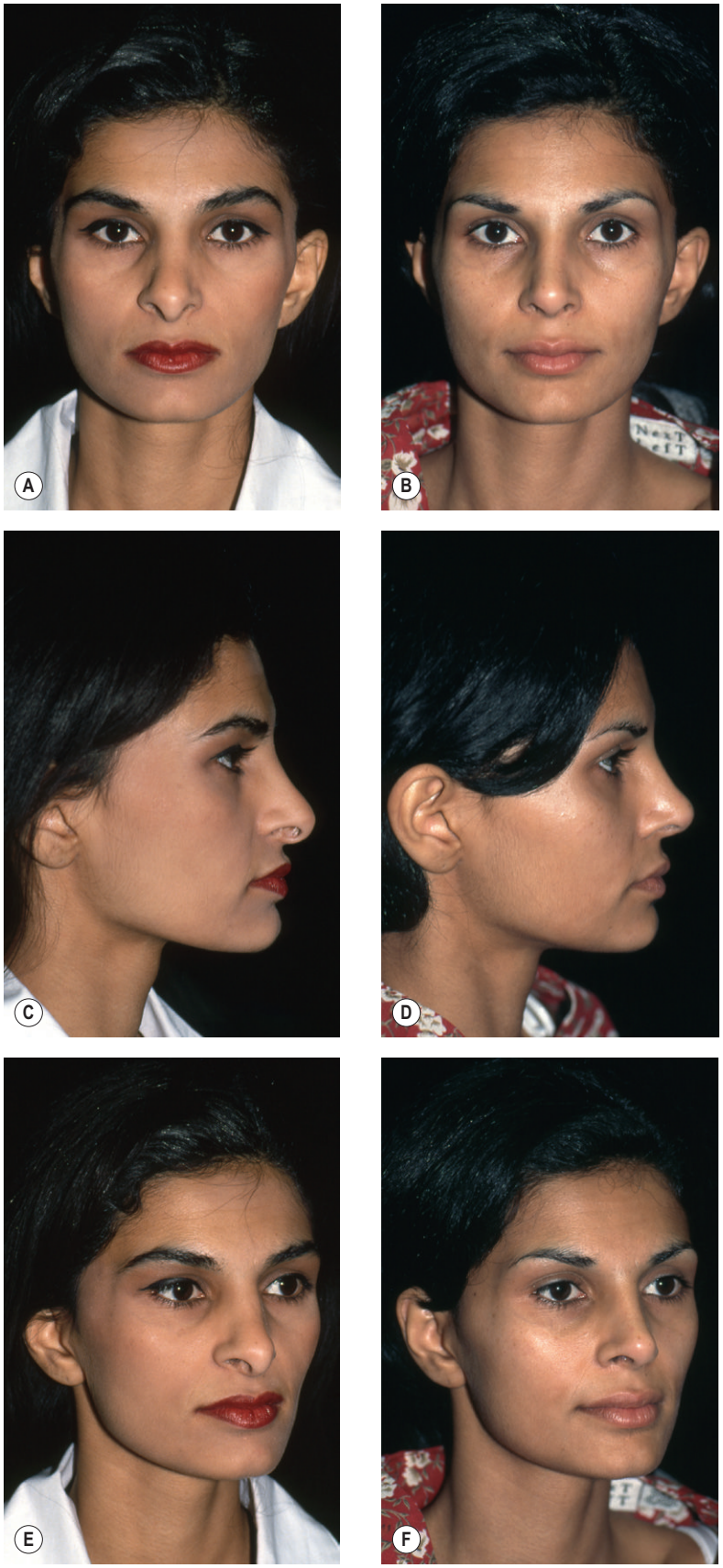


Figure 7.7 Standard rhinoplasty views of a patient before (A, C, E, G) and 32 months after (B, D, F, H) the Fred technique, whereby a reduction in columellar show has been achieved while nasal projection has been increased. The graphics illustrate the other soft tissue (I) and frame alterations (J) that were conducted on this patient.

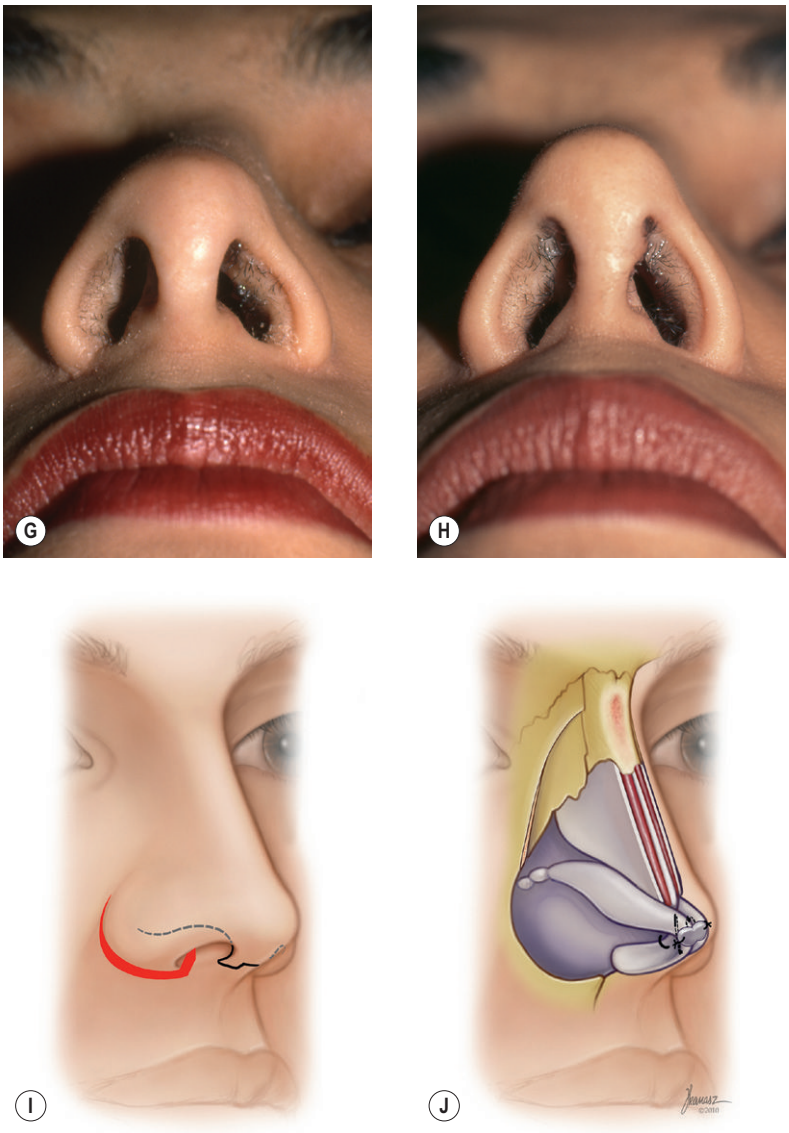


Figure 7.7, cont'd.

Animation 7.3). The repositioned medial crura are then fixed to the antero-caudal septum using 5-0 PDS sutures or 5-0 clear nylon. This technique can provide a significant increase in tip projection while retracting the hanging columella and widening the nasolabial angle, if necessary. One major disadvantage of this technique is that it makes the tip more rigid; the patient should be forewarned of this. It is only indicated in patients with excess columella show and inadequate tip projection (Figure 7.7; Animation 7.4; Box 7.4).

Animation 7.3 •
Animation 7.4

BOX 7.4

Surgical Steps: Figure 7.7

- An open technique was used
- The nasion was deepened
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was performed
- A low-to-low osteotomy was carried out bilaterally
- Bilateral lateral osteotomies were carried out
- The medial crura were approximated
- Transdomal sutures were placed
- A figure-of-eight interdomal suture was placed
- An onlay tip graft was applied
- The lower lateral cartilages were resected bilaterally
- The alar bases were narrowed bilaterally using combined excision

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1. *Adams Jr WP, Rohrich RJ, Hollier LH, et al. Anatomic basis and clinical implications for nasal tip support in open versus closed rhinoplasty. Plast Reconstr Surg 1999;103(1):255–261.*
2. *Guyuron B, Jackowe D. Modified tip grafts and tip punch devices. Plast Reconstr Surg 2007;120(7):2004–2010.*
3. *Guyuron B, Poggi JT, Michelow BJ. The subdomal graft. Plast Reconstr Surg 2004;113(3):1037–1040.*
4. *Fred GB. The nasal tip in rhinoplasty: use of the invaginating technique to prevent secondary drooping. Ann Otolaryngol 1950;59:215–223.*

Video 7.1 Use of a tip punch to harvest a tip graft.

Video 7.2 The graft is removed from the punch.

Video 7.3 The tip graft is fixed in position using 6-0 polyglactin sutures. Its position is monitored three-dimensionally to ensure that it is placed symmetrically.

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1. *Adams Jr WP, Rohrich RJ, Hollier LH, et al. Anatomic basis and clinical implications for nasal tip support in open versus closed rhinoplasty. Plast Reconstr Surg 1999;103(1):255–261.*
2. *Guyuron B, Jackowe D. Modified tip grafts and tip punch devices. Plast. Reconstr. Surg 2007;120(7):2004–2010.*
3. *Guyuron B, Poggi JT, Michelow BJ. The subdomal graft. Plast Reconstr Surg 2004;113(3):1037–1040.*
4. *Fred GB. The nasal tip in rhinoplasty: Use of the invaginating technique to prevent secondary drooping. Ann Otolaryngol 1950;59:215–223.*

CHAPTER 8

Elongation of the Short Nose

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Elongating a Short Nose with the Tongue-and-Groove Technique Animation 8.2

Animations

Pearls

- The etiologies of a short nose include iatrogenic factors, trauma, Wegener's granulomatosis and congenital deformities.
- When discussing the short nose, it is crucial to be clear whether the deficiency is in the anterior length, the posterior length, or both.
- A patient with short nose and retracted alae with rigid, fixed soft tissues of the nose poses a significant challenge in correction of the deformity.
- Minimal anterior length deficiency can be corrected with a shield graft.
- A significant nasal length deficit will require elongation of the dorsal frame using a tongue-and-groove technique.
- The two key components of the tongue-and-groove technique for nasal elongation include bilateral extended columella struts that protrude beyond the anterocaudal septum proportional to the elongation necessary and a columella strut that accommodates both the spreader grafts as well as medial crura creating continuity.

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- To be able to advance the alae effectively, it is crucial to dissect the lower lateral cartilages from the upper lateral cartilages and, if necessary, mobilize them completely and transpose them in a separate pocket caudally.
- If the intentions are to elongate the nose and gain more projection during the tongue-and-groove technique, 5–0 clear nylon is utilized to suture the spreader grafts to the columella strut in a more anterior relationship. Otherwise, these two structures are not fixed to each other to minimize nose rigidity.
- In case of inability to achieve enough length due to soft tissue limitations laterally, the compromise should be in the length of the nose rather than trying to protrude the columella, in which case, the alae will not be able to follow the central portion of the nose.

One of the features that makes rhinoplasty more complex is a length deficiency, especially if this is significant. In this chapter, we will discuss the etiology and management of the short nose, surgical techniques of nose elongation, and their variations.

Etiology and Pathology

Cephalic over-rotation of the nose is a hallmark of rhinoplasties performed from the 1960s to the mid-1980s. During this period in particular, iatrogenic short noses were commonly seen. Today, trauma is one of the common causes of a short nose. Although rare, there are patients who have had ablative surgery, have lost the septum to cocaine abuse or Wegener's granulomatosis, or were born with a short nose.

When discussing the short nose, it is crucial to be clear whether the reference is to the anterior length, the posterior length, or both. In other words, the nose can merely be over-rotated, or the entire nose can be short. These two types of short nose will require somewhat different management. The over-rotated nose is usually the consequence of surgical removal of a segment of the anterocaudal septum, collapse of the septum as a result of a caudal blow to the nose, or destruction of the septum by cocaine abuse. Generally, the nasal spine and the base of the columella are in the proper position and only anterior elongation is desired. Most congenitally short noses have deficiency evenly distributed through the caudal septum and the nasal spine is deficient or completely missing, as in a patient with Binder's syndrome.

Patient Assessment

The key to a successful correction of this type of deformity is an understanding of the nature of the deficiency and the involved structures. The goal of

the correction of this deformity should be optimal elongation of all of the deficient structures. It is, therefore, paramount to recognize the extent of the deficiency in the caudal septum, medial crura, lateral crura and the soft tissues. A patient with a short nose and retracted alae poses a far greater enigma than a patient who has hanging alae and a retracted columella. Additionally, the suppleness of the columella and the soft tissues is very important. The rigidly scarred nose that one cannot elongate by pulling the columella caudally is going to present more challenge in achieving sufficient length than the one that is supple enough to allow for manual elongation of the nose with ease.

Surgical Techniques

The management of the short nose is dependent on the magnitude of the deficiency. Additionally, the position of the alar rims makes a significant difference in the choice of corrective approach.

For a short nose with deficiency mainly in the infratip lobule and columella, where the alae are minimally retracted, the choice would be a shield-type tip graft applied through an open or closed technique, depending on the other necessary maneuvers, along with alar rim grafts. If placement of a shield graft is the sole maneuver, it can be placed through a marginal incision that is placed along the anterior portion of the columella and extends laterally.[1] Commonly, however, this type of minor nose length deficiency is corrected in conjunction with many other abnormalities, often requiring exposure of the medial and lateral crura. In this scenario, the medial crura are approximated first. A shield graft is then carved using a tip punch (Figure 8.1).[2] While a septal cartilage graft is preferred, a conchal graft can also be used. The punch

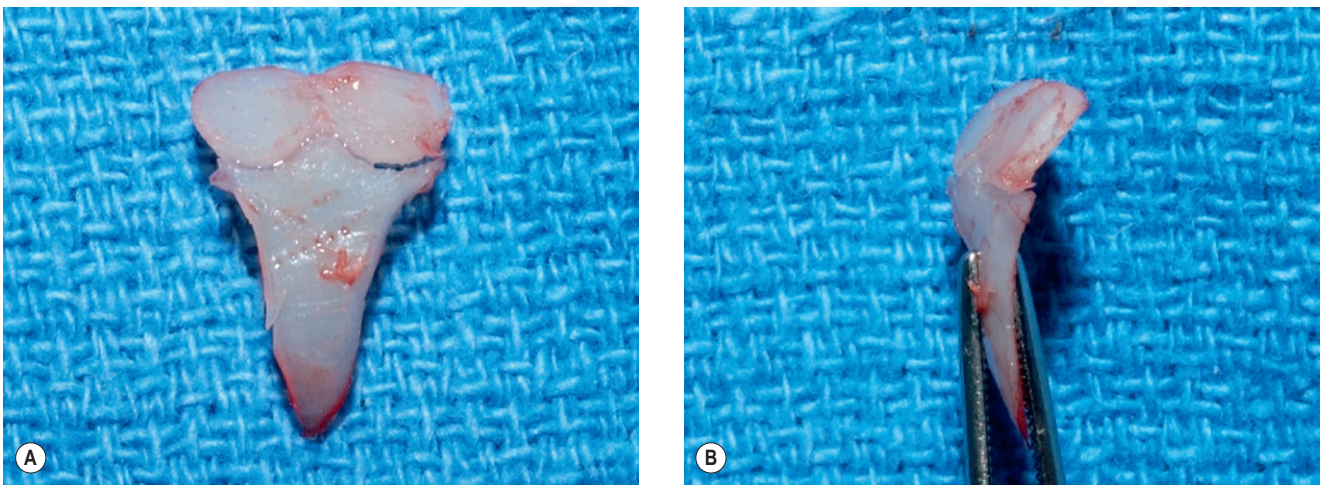

Figure 8.1 A shield graft is harvested using a tip punch. (A) Front view. (B) Profile view.

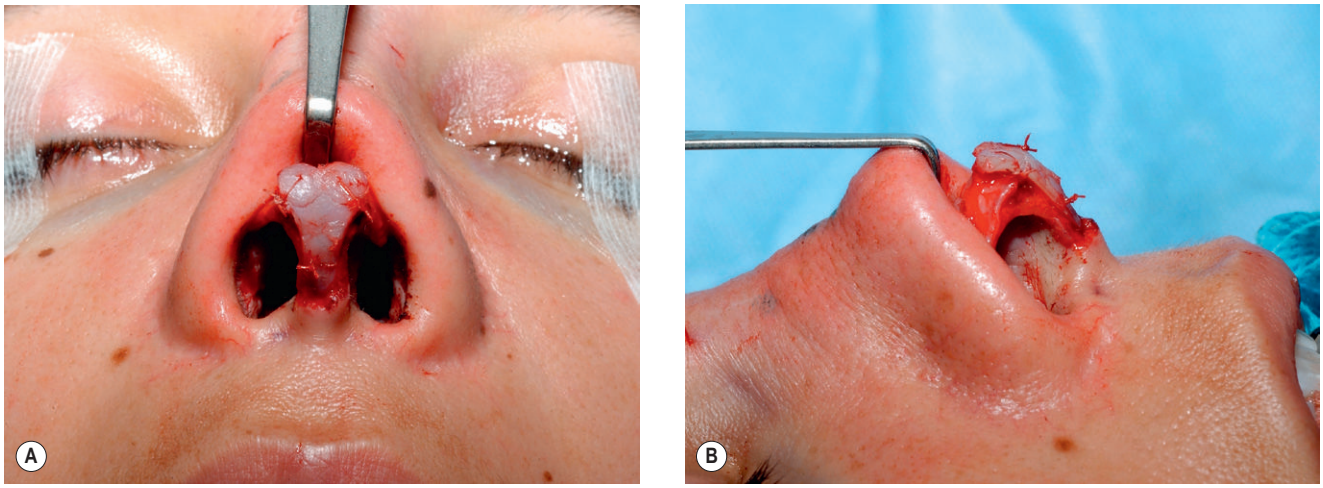

Figure 8.2 The shield graft is sutured in position three-dimensionally and viewed from the basilar view (A) and profile view (B).

carves an anatomically shaped graft with two round attached segments cephalically, emulating the natural domes and an infratip portion. The graft is designed in such a way that it can either drape over the existing domes where a tip projection deficiency coexists, in which case it will not have a clearly visible outline, or it can be added caudal to the current domes to achieve simple elongation of the nose without adding tip projection. The margins are beveled, particularly on patients with thin skin, to diminish graft visibility. The graft is sewn in position precisely while it is observed three-dimensionally (Figure 8.2). For fixation, 6-0 polyglactin is used because it ties more easily and the residual ends are not firm enough to create palpable or visible irregularities. A second layer can be applied if necessary. Depending on the magnitude of the deficiency and the thickness of the selected cartilage, one layer is usually sufficient. Three stitches are applied: one on each dome area and one on the columella. As an example, Figure 8.3 shows a patient who would benefit from this type of tip elongation. This technique can be combined with an alar rim graft or V–Y advancement to advance the ala caudally and restore congruity between the alae and the lobule.

In cases of moderate to severe length deficiency, the choices include a septal extension graft, a composite graft or a tongue-and-groove-type elongation with extended spreader grafts. A septal extension graft can be prepared and placed in continuity with the septum and sutured to the medial crura. The challenge here is maintaining the alignment. Since there are no reliable means of containing the septal extension graft in continuity with the septum, there is a good chance that it will ultimately shift to one side. It is therefore prudent to add some type of graft to both sides of the septum proper to keep the graft in position. Although some surgeons successfully use such additional grafts, the added bulk may alter the anatomy of the vestibule and create unnecessary extra bulk on one side of the septum, which may induce some asymmetry.

Figure 8.3 A patient with an anteriorly short nose that has been corrected with a shield graft. Other views of this patient are shown in Figure 3.4 in Chapter 3 and Figure 19.18 in Chapter 19.

The tongue-and-groove technique we describe below has been extremely successful in maintaining alignment.[3]

Tongue-and-Groove Technique

This technique is an optimal method of elongating a moderately to severely short nose, especially one that has been over-rotated. Through an exonasal approach, after removing dorsal irregularities and performing any necessary osteotomies, two pieces of long spreader graft are harvested, ideally from the septum, or from the rib if the septum is not available. Conchal cartilage is not suitable for this purpose. The cartilage grafts are tailored so that they are long enough to extend from underneath the nasal bones to beyond the anterocaudal septum in proportion with the elongation required (Figure 8.4a, b; Animation 8.1). For example, if the deficiency is 4 mm, the spreader grafts

Animation 8.1 •

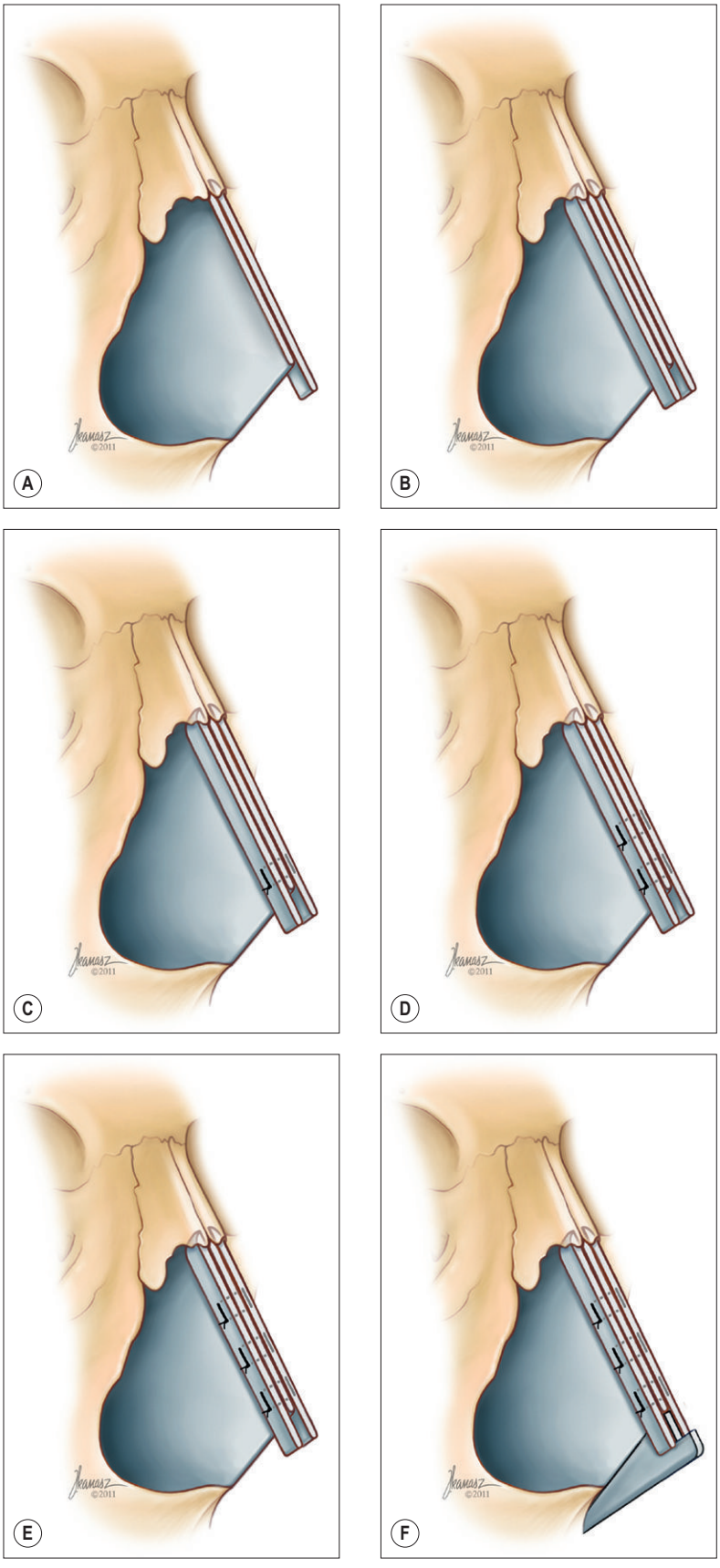

Figure 8.4 Spreader grafts (A, B) are added on each side, extending beyond the anterocaudal septum proportional to the elongation necessary and fixed to the septum using three mattress sutures of 5-0 PDS (C–E). A columella strut is placed in position that has a width equal to the required elongation of the nose plus the width of the medial crura (F). The medial crura are sutured to the newly placed strut in at least two places (G–I).

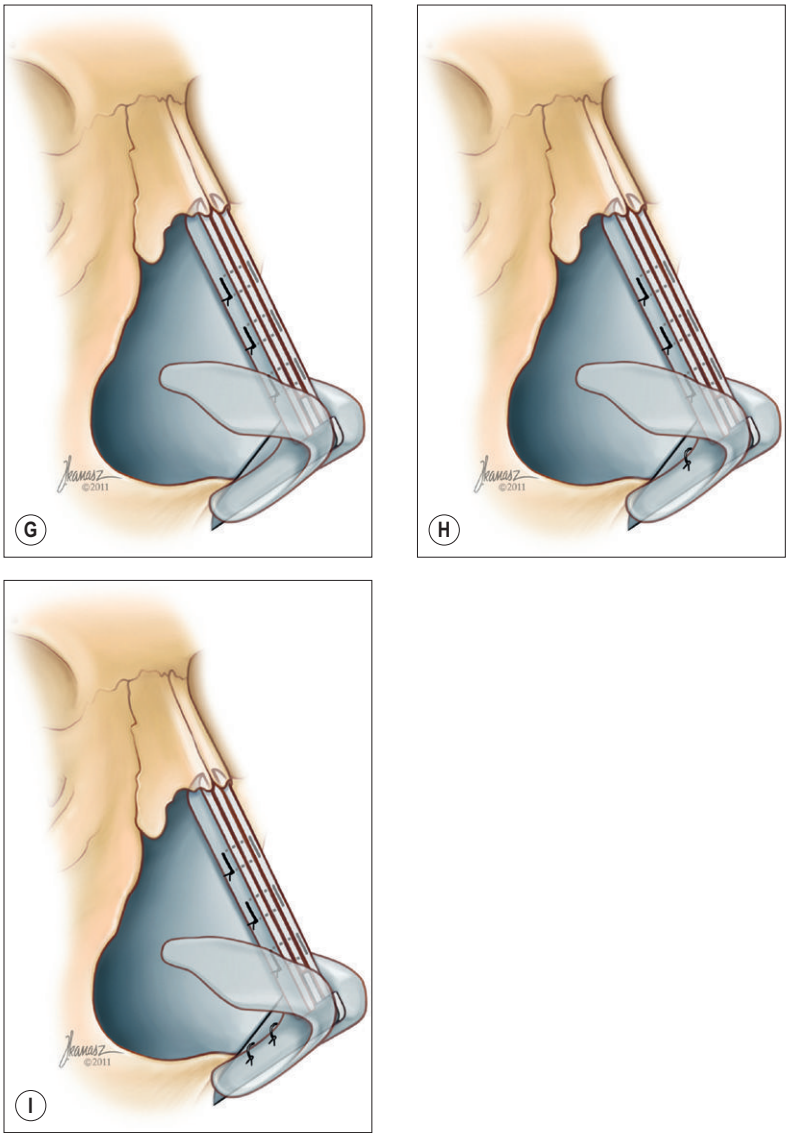

Figure 8.4, cont'd.

will extend 4 mm beyond the anterocaudal septum. The grafts are placed in position and sutured to the septum and to each other using two or three sutures of 5-0 double-armed polyglactin (Figure 8.4c–e). The upper lateral cartilages are then sutured to the spreader grafts using 5-0 PDS. Next, a triangular columella strut is prepared if the anterior nasal spine and caudal septum are in a proper position posteriorly (Figure 8.4f). Otherwise, the base of the columella is also advanced by carving a graft that also has enough width posteriorly. The anterior dimension of the columella strut should equal the elongation necessary; in this example 4 mm, plus the width of the medial crura. For example, if the medial crura are 4 mm wide, the anterior width of the columella strut will be 8 mm. Thus, as the medial crura are sewn to the columella strut, the anterior nose will be elongated by 4 mm. If the footplates

are divergent, one has to consider the caudal advancement of the columella base that will occur as a result of approximation of the footplates. The medial crura are then approximated to the columella strut and sutured in at least two sites using 5-0 PDS (Figure 8.4g–i).

Ideally, the columella strut is not sutured to the extended spreader grafts unless increased tip projection is required as well as elongation of the nose. In this case, 5-0 clear nylon is used to suture the medial crura to the columella strut in a more projected position. The portion of the columella strut between the extended spreader grafts should end at the level of the anterior limits of the spreader grafts and the dorsum while the portion between the medial crura should extend to the most projected portion of the domes, often 6–8 mm anterior to the spreader grafts, depending on the thickness of the overlying skin. This means that the portion of the columella strut that extends anterior to the spreader grafts is as wide as the medial crura only. As a result, a supratip fullness will be avoided.

It is absolutely essential to make sure that the lateral crura follow the central structures. To facilitate this, the lateral crura of the lower lateral cartilages are carefully dissected, and if necessary, completely mobilized, rotated caudally, and placed in a new soft tissue pocket. This may necessitate placement of a Gunter lateral crural strut to achieve an aesthetically more pleasing outcome and functionally stronger external valves. In patients with significant scarring, it may be necessary to release the scar tissue in order to advance the frame caudally. It is often necessary to elevate the soft tissues further cephalically along the dorsum and even along the nasal bones to allow them to be freely advanced. If the soft tissues are found to be irreparably scarred, they are released, making an incision in the nasal lining. Next, an elliptical piece of composite ear skin and conchal cartilage is harvested and applied to either side, cephalad to the existing lower lateral cartilages and extended to the membranous septum. This is seldom necessary, even in noses that appear to be severely scarred. Careful dissection of the soft tissues and a properly planned and elongated frame will usually yield a surprisingly significant length and will stretch the soft tissues proportionally. This operation, while labor-intensive, is very rewarding (Figure 8.5; Animation 8.2; Box 8.1).

Animation 8.2 •

Potential Shortcomings and Pitfalls

If the nose elongation is combined with a gain in tip projection, which requires suturing the columella strut to the extended spreader grafts, it will result in some rigidity of the nose tip. As long as the patient is forewarned of this change, it does not pose a significant problem. One of the potential undesirable outcomes is a successful advancement of the tip and columella while the alae are not proportionally advanced. This will create an unfavorable protrusion of the columella and alae that appear to be retracted. Sufficient dissection of the soft tissues and repositioning of the lateral crura will

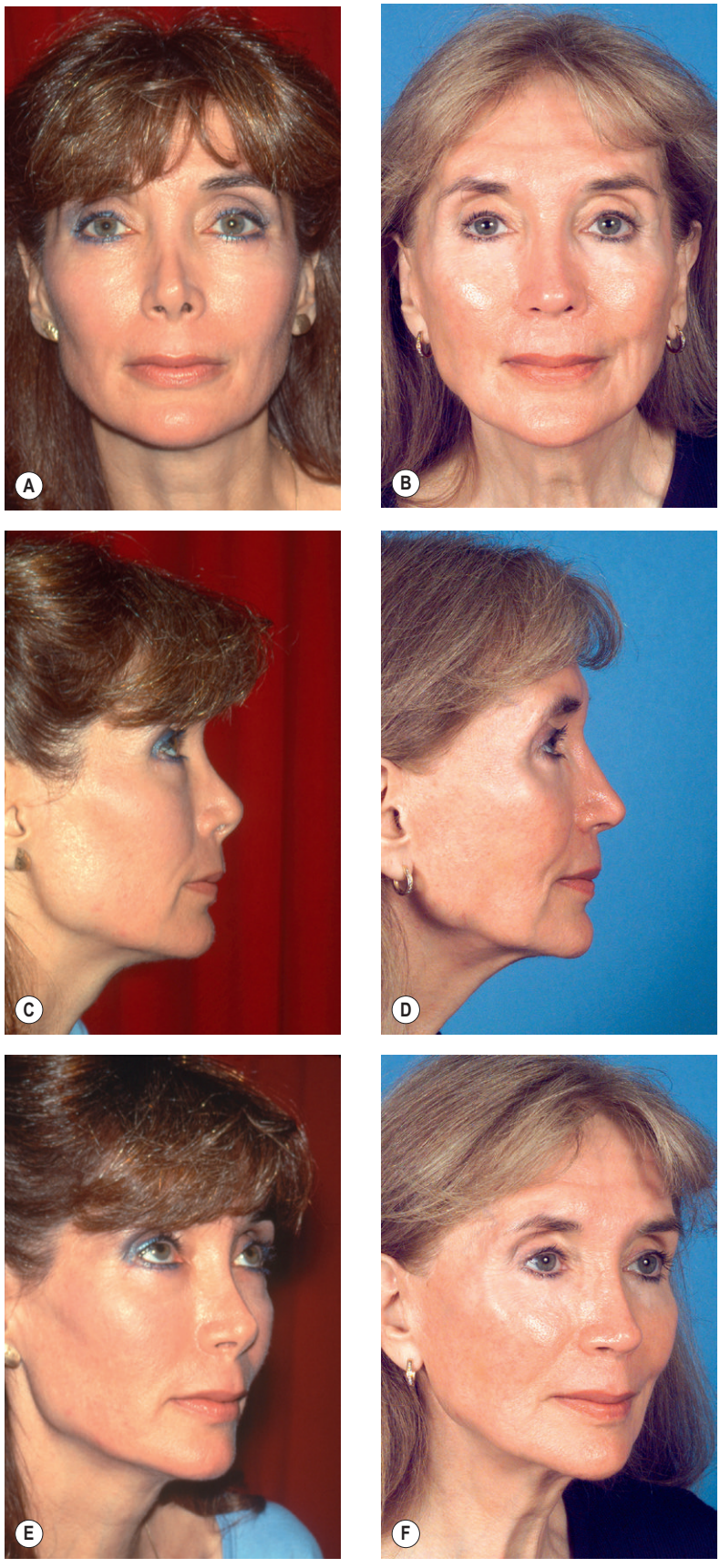

Figure 8.5 A patient before (A, C, E, G) and 12 years after (B, D, F, H) elongation of a secondary short nose using the tongue-and-groove technique. The illustrations demonstrate the soft tissue (I) and frame alterations (J) to achieve the intended goals.

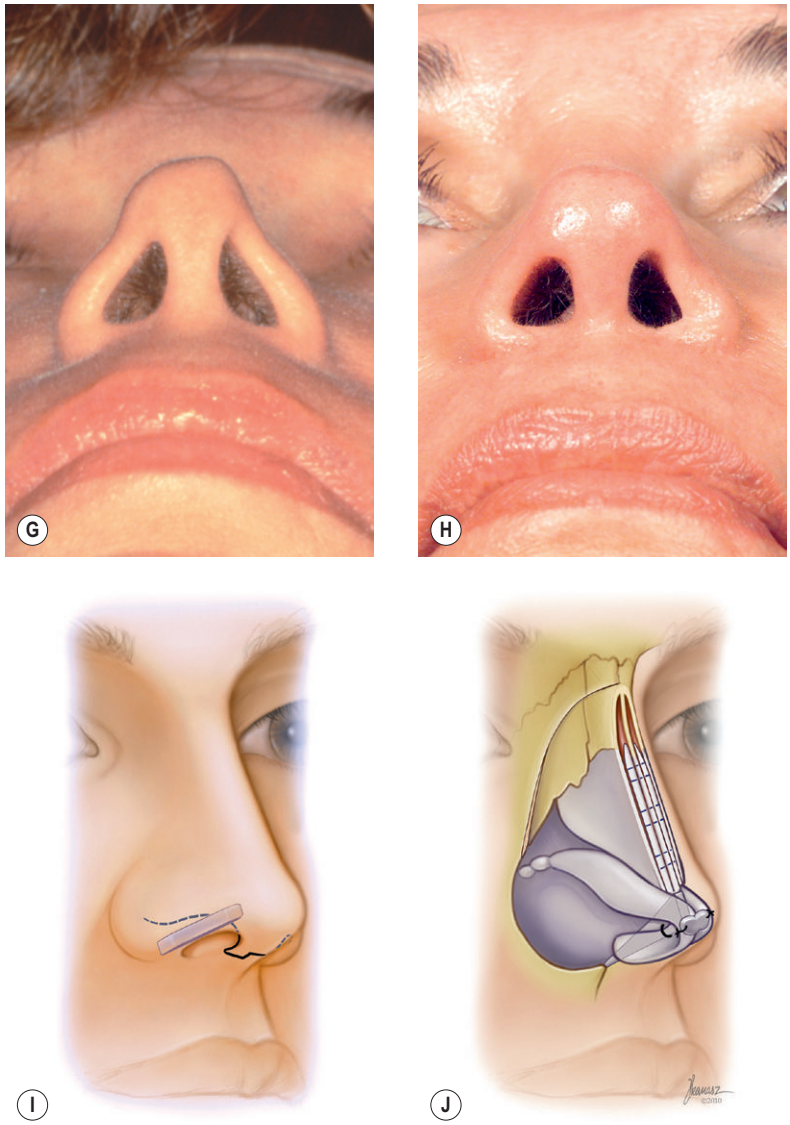

Figure 8.5, cont'd.

BOX 8.1

Surgical Steps: Figure 8.5

- An open technique was used
- A low-to-low osteotomy was carried out bilaterally
- The nose was elongated using a tongue-and-groove technique
- A columella strut was used
- The medial crura were approximated
- An onlay tip graft was inserted
- A dorsal graft was utilized
- Bilateral alar rim grafts were applied
- An upper lateral extension graft was placed

reduce the potential for this. If necessary, alar rim grafts or a lateral crural strut should be utilized to make sure that the alae follow the central portion of the nose. In general, a slightly short nose with a balanced relationship between the alae and the columella is less displeasing than a longer nose where the central portion is protruding. This means that in case of inability to achieve enough length due to immobility laterally, the compromise should be in the length of the central nose rather than trying to protrude the columella, in which case, the ala will not follow the central portion of the nose.

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CHAPTER 9

Correction of the Overprojected Nose

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Pearls

- Ideally, one should see a differential level of 4–6 mm between the glabella and the dorsum, which identifies the depth of the radix.

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- An underprojected forehead and glabella can ostensibly make the radix appear shallow. However, in reality, the problem is with the forehead and not the radix or the rest of the nose.
- The forehead should protrude 10–15 mm anteriorly in relation to the globe on the profile view.
- A shallow radix can readily be achieved using a guarded burr with a side-to-side motion.
- The overprojected dorsum will be removed component by component, including the nasal bones, lower lateral cartilages, and septum proportionally.
- Before reducing the caudal dorsal projection, one must take into consideration that removal of the cephalic margin of the lower lateral cartilages, reduction of the nasal spine, lowering the caudal dorsum, and transfixion incision will each reduce the tip projection.
- Some noses that appear to have an overprojected tip may, at the end of the surgery, require additional tip support.
- Careful analysis of the face and nose may indicate that the nose is overprojected and is short, of optimal length, or long.
- If the nose is long and overprojected, one can reduce the tip projection by transecting and overlapping the lateral crura which will accomplish both objectives of shortening the nose and reducing the projection at the same time. The caudal septum has to be removed in a wedge shape proportionally to allow the cephalic rotation of the nose.
- If the nose is short and the tip is overprojected, the medial crura are transected and overlapped to reduce the tip projection while rotating the tip caudally.
- If the nose has a proper length but is overprojected, both the medial crura and the lateral crura are transected and overlapped proportionally and equally.
- A short and overprojected tip can be corrected with an anchor suture that, after passing through the medial crura, will be passed through the posterior portion of the caudal septum.

The overprojected nose is one of the most disturbing disharmonies of the nose. This is especially true when the nose is also too long. The overprojection can be cephalad, dorsal or caudal. However, a combination of all three often coexists.

Overprojected Cephalad Nose

In this fairly common presentation, the radix is too shallow or there is no radix definition and the transition from the forehead to the nose occurs in a linear fashion. As was discussed in Chapter 2, one should ideally see a differential of 4–6 mm between the glabellum and the dorsum on the profile view in a congruous nose. A nose with an overprojected cephalic portion gives the patient the appearance of a reduced intercanthal distance (Figure 9.1), especially if the dorsum and the radix are narrow in addition to being overprojected. One has to differentiate between an overprojected cephalic nose and a receding forehead. In some of the syndromal conditions with mild

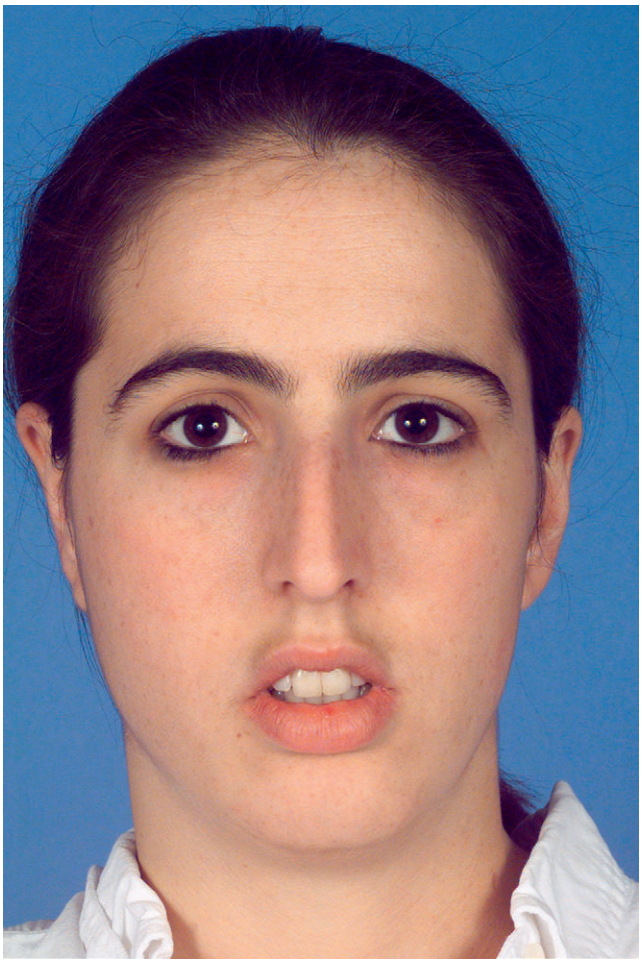


Figure 9.1 A patient with an overprojected nose who appears to have a reduced intercanthal distance.

deformities, whereby the condition cannot be readily recognized, an underprojected forehead and glabellum may produce the ostensible appearance of a shallow radix. Here, one has to assess the distance of the supraorbital rim from the anterior surface of the cornea on straight gaze using the profile view. This measurement should be between 10 and 15 mm. If it is less than 10 mm, then the forehead is underprojected rather than the radix being overprojected.

Management of Overprojected Cephalic Nose

Correction of overprojected cephalic nose and shallow radix has been discussed in Chapter 4. A guarded burr is used (see Video 4.1; Figure 4.2) to deepen the nasion. This device is extremely powerful and can deepen the radix too much, so it should be used with the utmost precision.

Dorsal Overprojection

A midvault overprojection is essentially the presence of a hump after lowering the radix. Many such patients also present the appearance of reduced intercanthal distance (Figure 9.1). Elimination of the dorsal overprojection results in an open roof and this mandates osteotomy of the nasal bones. It is crucial to recognize that significant reduction of the dorsal overprojection followed by osteotomy obligates the use of spreader grafts or flaps. If spreader grafts are not used, an inverted V deformity may result, which may not be evident until months or years postoperatively.

Overprojected Caudal Nose

Successful correction of this nasal deformity requires significant rhinoplasty experience and a clear understanding of nasal dynamics. As indicated in Chapter 3, many of the maneuvers routinely conducted inadvertently reduce tip projection. These include removal of the cephalic margin of the lower lateral cartilages, reduction of the nasal spine, lowering of the caudal dorsum, transfixion incision, with consequent scar contracture, and even simply the use of the open technique.[1] It is therefore essential to take these changes into consideration when computing the aesthetic goals. When these maneuvers are conducted in a variety of combinations, there will be enough reduction in tip projection to avoid an additional specific maneuver to reduce the projection of the tip structures. Ironically, some noses that appear to have an overprojected tip may, at the end of surgery, require additional tip support. However, after the aesthetic plans are executed, if it appears that tip projection will not be sufficiently reduced, additional surgical maneuvers may be employed to diminish the projection.

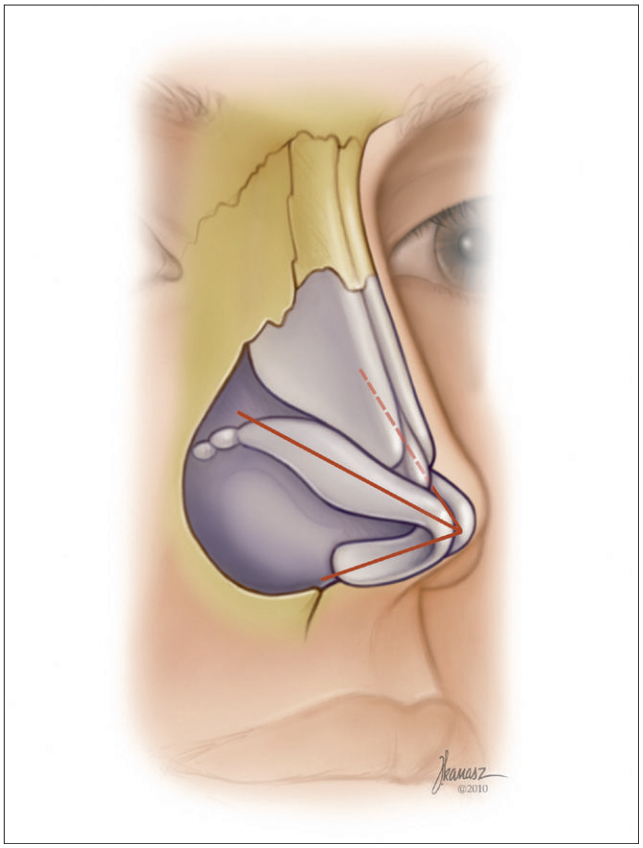
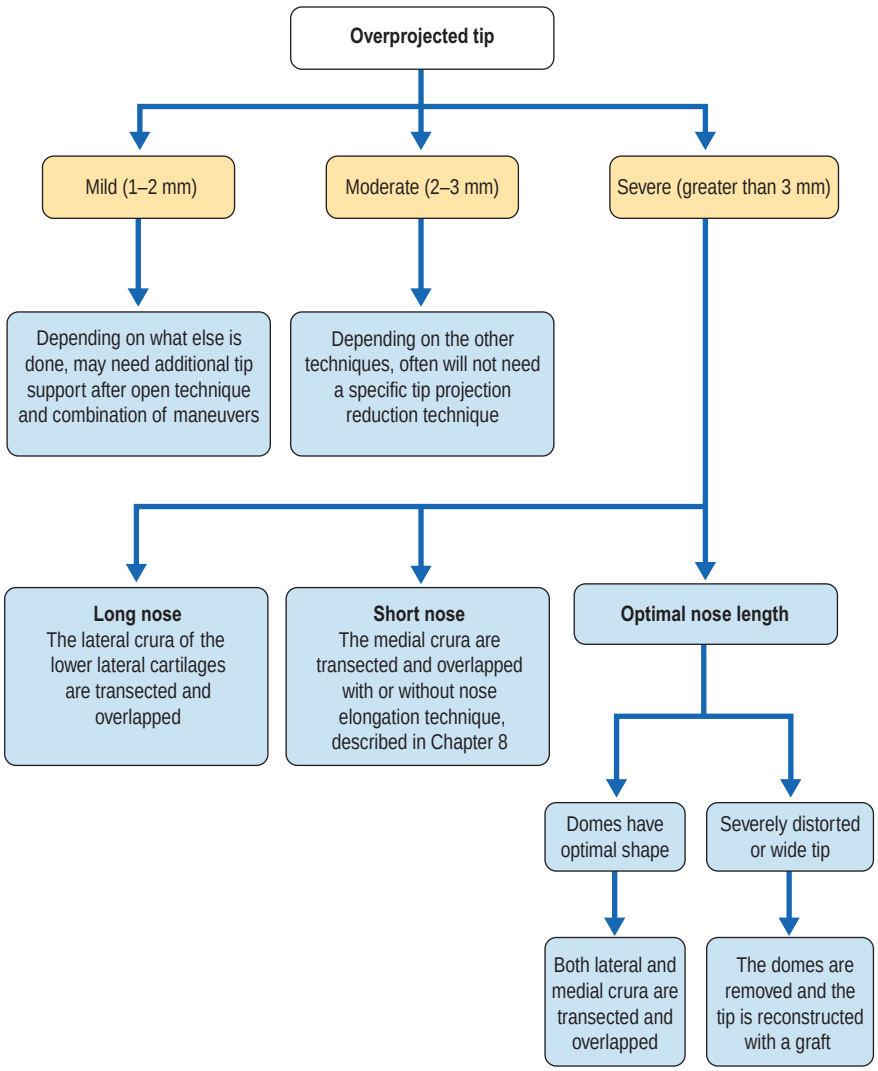


Figure 9.2 The medial crura comprise the caudal limb of the tripod, and the lateral crura make up the other two limbs.

A careful analysis of the face and nose may indicate that the nose is overprojected and is either short, of optimal length, or long. Each of these presentations requires different management. In this regard it is crucial to understand and consider the concept of the tripod as it pertains to tip projection. The tripod concept, advocated by Anderson[2] and by Gunter & Yu,[3] likens the supporting structure of the tip to a tripod, the central caudal limb of which comprises the two medial crura, and the lateral limbs the lateral crura of the lower lateral cartilages (Figure 9.2). Elimination of excessive tip projection will therefore be achieved by reducing the various limbs of this tripod, taking into consideration the preoperative nasal length. If the nose is long and overprojected, one can reduce tip projection by transecting and overlapping the lateral crura, which will accomplish two goals at the same time (Table 9.1). This maneuver reduces tip projection and rotates the tip cephalically, thus shortening the nose. It is important to remove an appropriate amount of caudal septum and a proportional amount of membranous septum

Table 9.1 Algorithm for Correction of Overprojected Tip


Overprojected tip
Mild (1–2 mm)
Moderate (2–3 mm)
Severe (greater than 3 mm)
Depending on what else is done, may need additional tip support after open technique and combination of maneuvers
Depending on the other techniques, often will not need a specific tip projection reduction technique
Long nose
The lateral crura of the lower lateral cartilages are transected and overlapped
Short nose
The medial crura are transected and overlapped with or without nose elongation technique, described in Chapter 8
Optimal nose length
Domes have optimal shape
Severely distorted or wide tip
Both lateral and medial crura are transected and overlapped
The domes are removed and the tip is reconstructed with a graft

Animation 9.1 • 9.2 • 9.3

lining at the same time (Figure 9.3; Animation 9.1). The segments of the lateral crura are sutured together using 6-0 polyglactin, with the anterocaudal segment of the cartilage overlapping the posterocephalic segment while the latter is in the medial position. Insertion of a lateral crural strut strengthens the weakened lateral crura. If the nose is short and the tip is overprojected, the medial crura are transected and overlapped to reduce tip projection while rotating the tripod caudally (Figure 9.4; Animation 9.2). The segments are secured to each other, and preferably to a columella strut, in order to control the projection of the tip and the length of the nose while maintaining stability. If the nose has the proper length but the tip is overprojected, the projection is decreased by transecting both the medial and lateral crura and overlapping the cartilages (Figure 9.5; Animation 9.3).

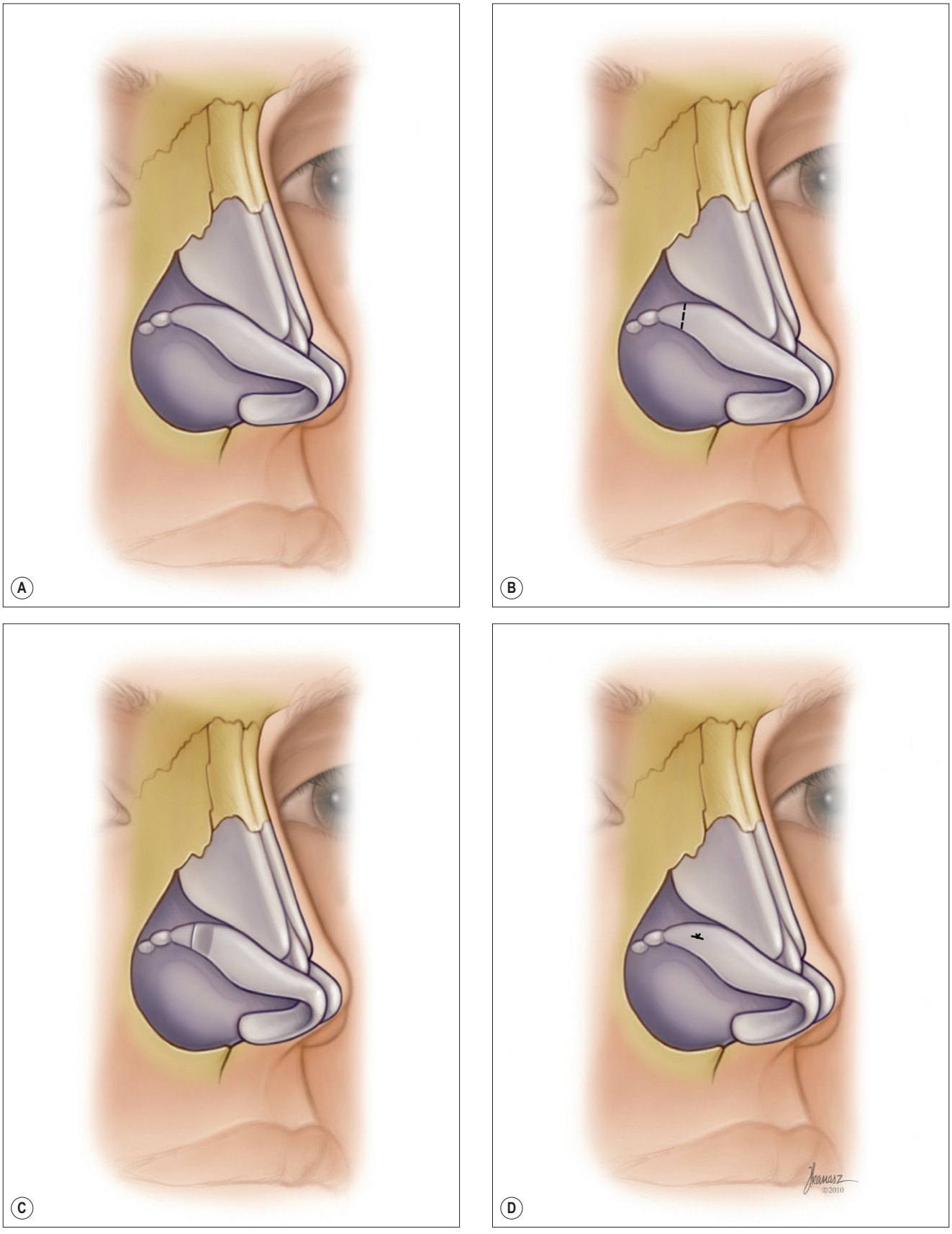


Figure 9.3 An overprojected tip on a long nose is corrected by transecting and overlapping the lateral crura of the lower lateral cartilages.

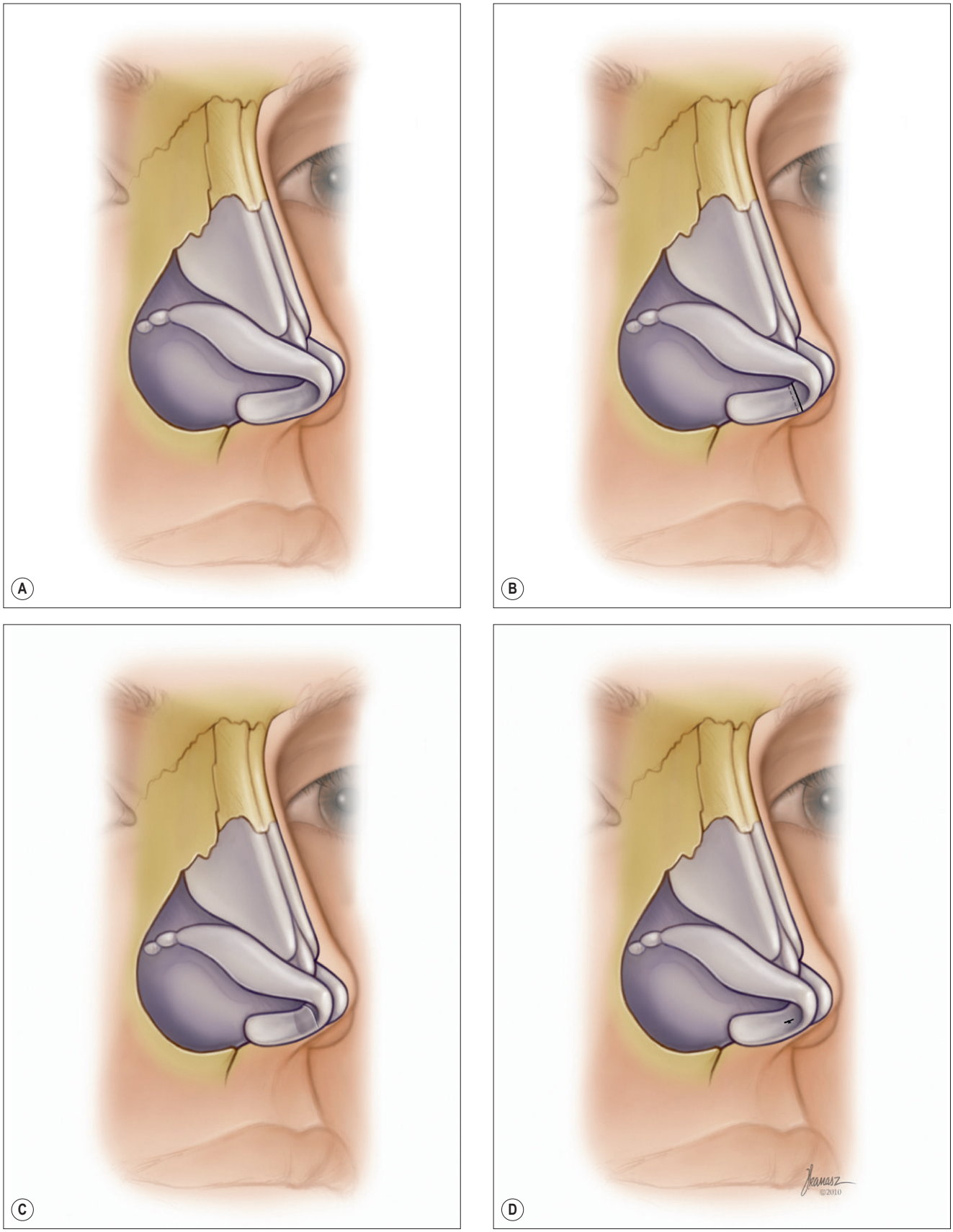


Figure 9.4 When the nose is overprojected and short, the medial crura are transected (A, B), overlapped, and sutured (C, D).

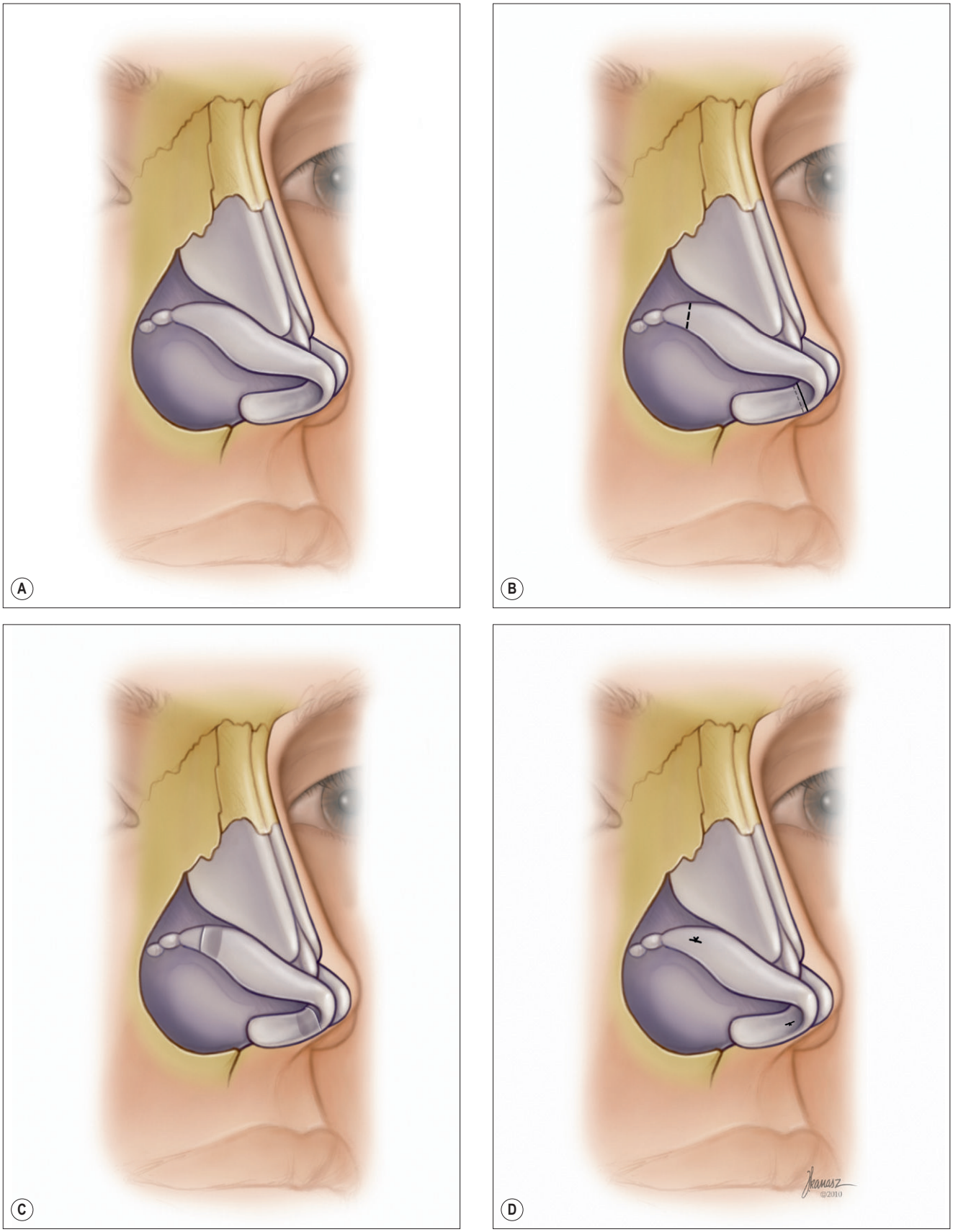


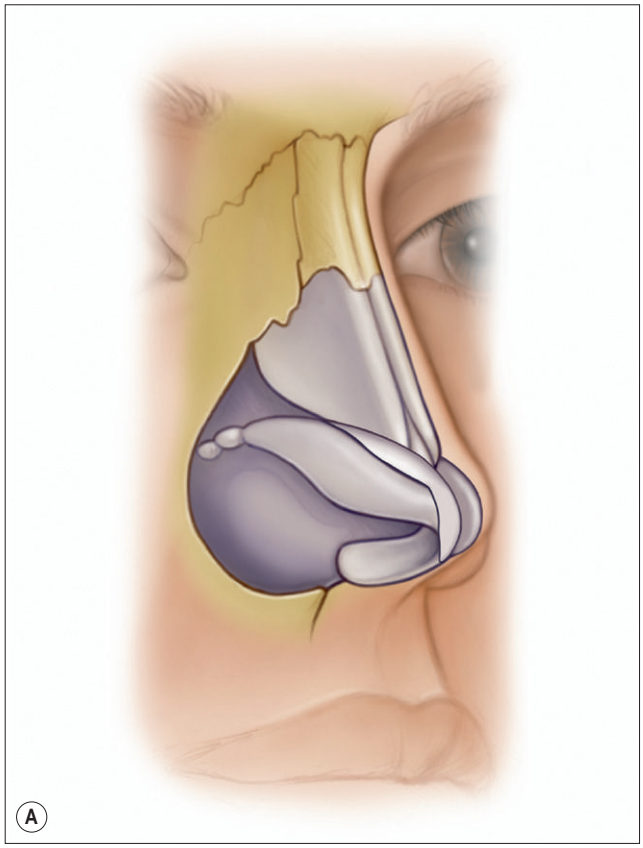
Figure 9.5 In a nose of optimal length with tip overprojection both the medial and lateral crura are transected (A, B) and overlapped (C, D).

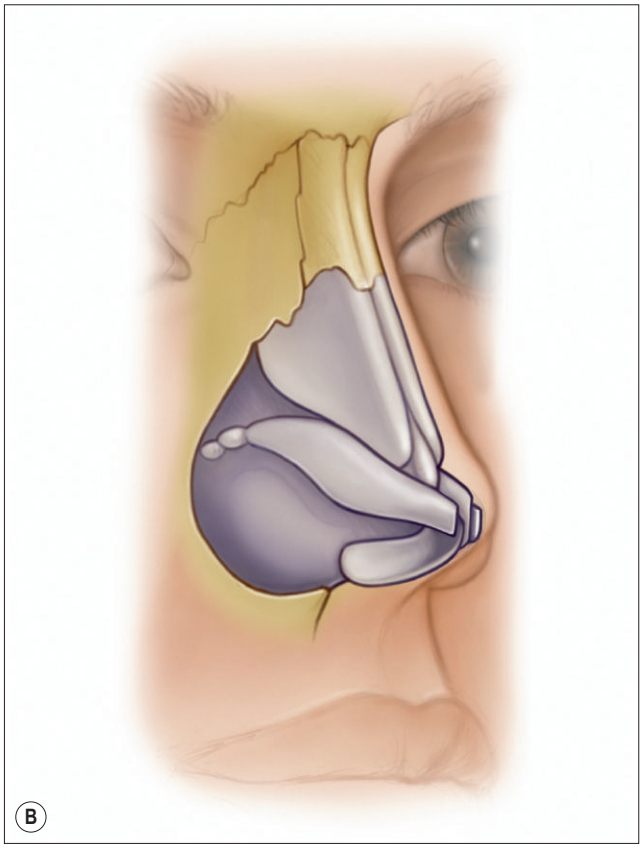
A short and overprojected tip can also be corrected with an anchor suture, which is passed through the footplates, tied, and then passed through the caudal septum more posteriorly. As the suture is tied, it will drag the basilar unit posterocaudally. This results in an unusual configuration to the junction of the lip and columella and commonly narrows the tip, which may or may not be beneficial to the nose.

Removal of the domes that are very distorted and wide on an overprojected tip can more effectively be accomplished by removal of the domes. However, this is very destructive and the tip structures have to be reconstituted. In this scenario, an open technique is the preferred approach. The domes are dissected and separated from the underlying lining (Figure 9.6a; Animation 9.4; Video 9.1). Both domes are removed and the projection is reduced more than is considered ideal for the patient (Figure 9.6b; Video 9.2), proportional to the thickness of the tip graft to be added. A columella strut is prepared and placed in position (Video 9.3) to create more stability. Next, a tip graft is harvested from the septal cartilage using a tip punch (Figure 9.6c; Video 9.4) and, while being monitored three-dimensionally, is sutured in place precisely, using 6-0 polyglactin or Vicryl. The lateral crura are approximated to the newly placed graft to restore the function of the external valve. The redundant soft triangle lining is excised on each side and a 5-0 chromic suture is used to repair the lining (Video 9.5). The open incision is then repaired using 6-0 fast absorbable catgut. A patient who underwent removal of the domes in this way is illustrated in Figure 9.7 (Animation 9.5). On the other hand, the patient in Figure 9.8 did not undergo a specific maneuver to reduce tip projection, since a combination of reduction of the caudal dorsum, nasal spine, and cephalic margin of the lower lateral cartilages afforded enough reduction in tip projection for alteration of the nasal tripod to be unnecessary (Box 9.1).

Animation 9.4 • 9.5

Video 9.1 • 9.2 • 9.3 • 9.4 • 9.5





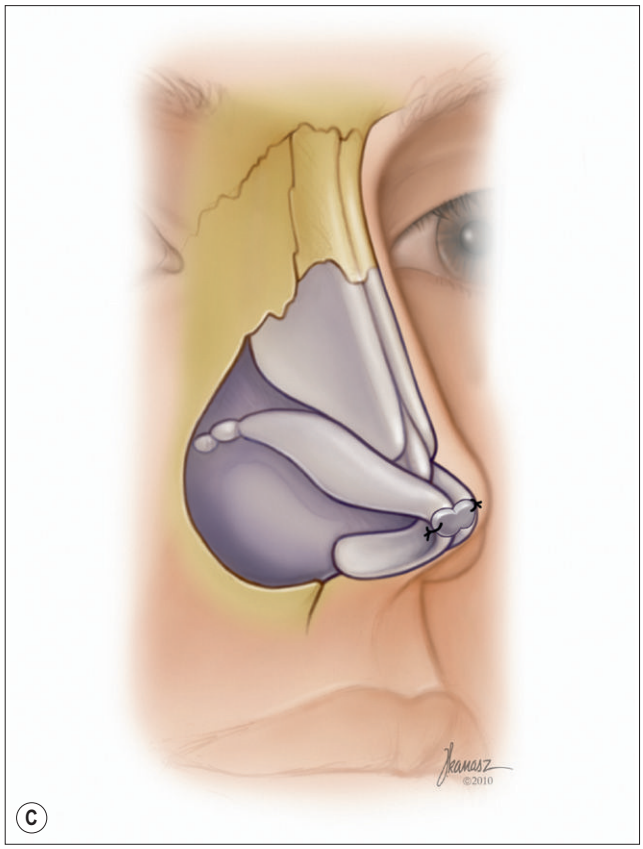


Figure 9.6 The steps involved in lowering tip projection using the dome reduction technique.

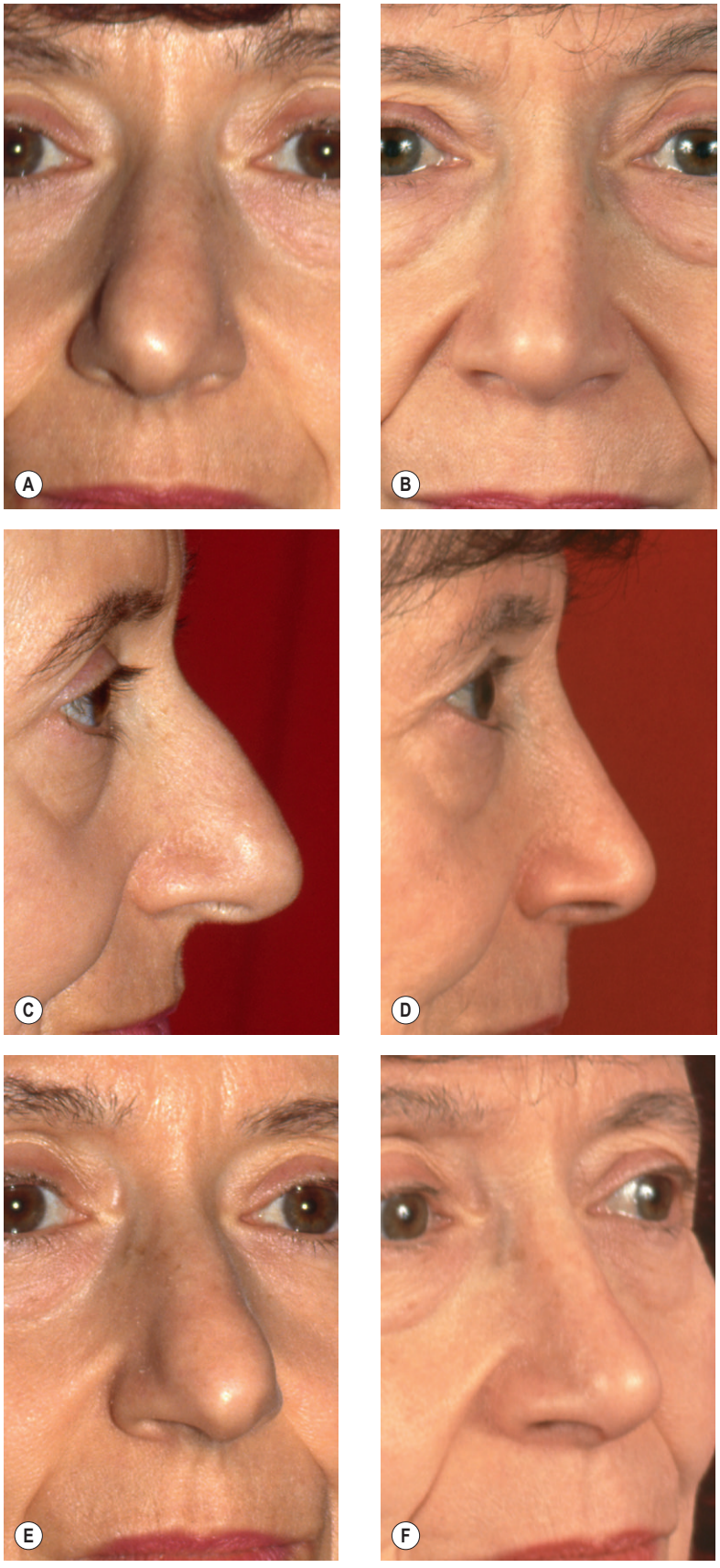


Figure 9.7 Preoperative (A, C, E, G) and 11-year postoperative (B, D, F, H) views of a patient with wide, distorted, asymmetrical tip, and cephalically oriented lower lateral cartilages and significant overprojection who was a good candidate for reducing the overprojection by removal of the domes and replacement with grafts. Illustrations I and J demonstrate the other maneuvers conducted on this patient.

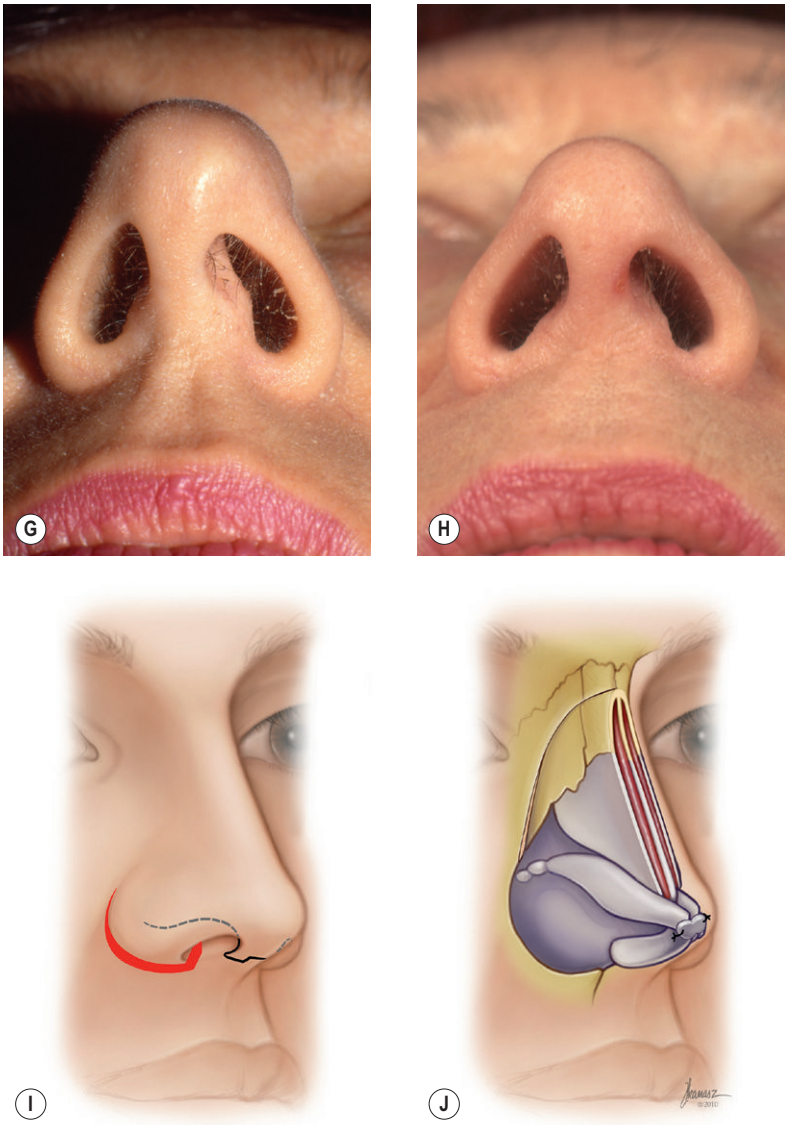


Figure 9.7, cont'd.

BOX 9.1

Surgical steps: Figure 9.7

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A low-to-low osteotomy was carried out bilaterally
- The domes were lowered bilaterally
- The caudal borders of the medial crura were removed bilaterally
- The alar bases were narrowed bilaterally using combined excision

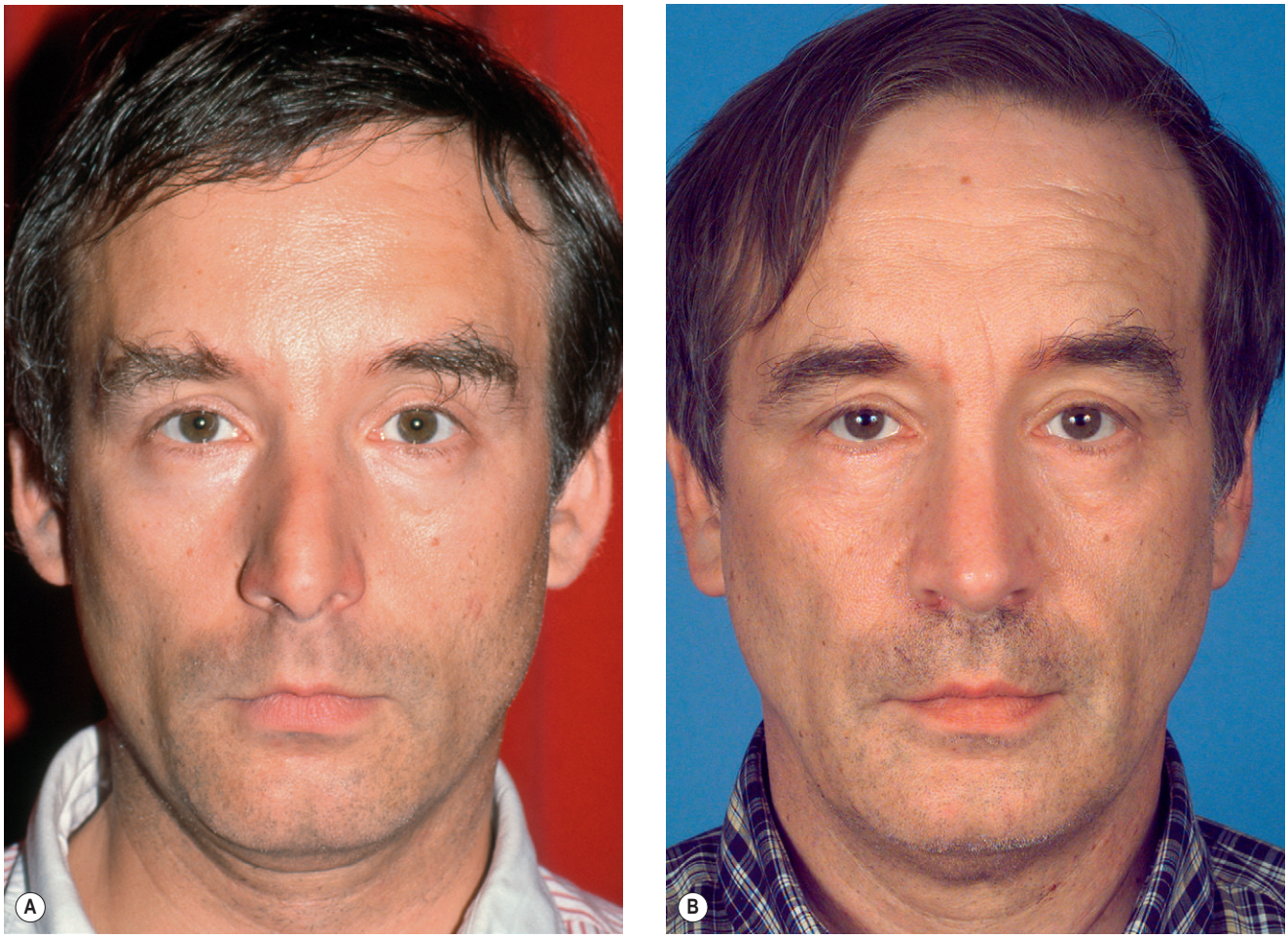


Figure 9.8 A patient with an overprojected nose who did not need any manipulation of the tripod as the tip projection was reduced significantly by the concomitant maneuvers. Lateral views of this patient can be seen in Figure 3.34 in Chapter 3.

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Video 9.1 The domes are separated from the underlying lining using a pair of iris scissors. The extent of the lining will depend on the amount of cartilage that needs to be removed.

Video 9.2 The domes are lowered beyond what is optimal for the patient considering the thickness of the cartilage that will be applied over the existing medial and lateral crura.

Video 9.3 The columella strut is placed in position and trimmed.

Video 9.4 A tip graft is harvested using the tip punch. The graft is placed in position and fixed using 6-0 polyglactin. The first suture will fix the graft to the underlying medial crus. Next, the graft is sutured to the lateral crus on the same side. As the suture is being tied, the position of the graft is monitored three-dimensionally. The graft is then sutured to the opposite side.

Video 9.5 The redundant portion of the lining under the newly constructed dome is excised in a triangular shape. The resulting defect is then repaired using 5-0 chromic interrupted sutures.

10 CHAPTER

Rhinoplasty on Patients with Cleft Lip Nose Deformity

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Pearls

- Ideally, the secondary cleft lip rhinoplasty should be performed at about the age of 14–15 years for a female and 17–18 years for a male.
- The secondary cleft lip nose repair should be carried out after the maxillary deficiency has been corrected and the platform that supports the nose has been brought to a proper position and symmetry.
- Nearly 60% of patients who have cleft lip nose deformity have difficulty breathing through the nose.
- The major tenets of a proper correction of cleft lip nose deformity include complete exposure of the lower lateral cartilages, removal of the excessive soft tissues between the domes, dissection, and repositioning and fixation of the lateral crus to the columella strut.

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- It is crucial to recreate the central portion of the nasal tripod in a proper position with adequate strength by application of a columella strut, and application of a nasal spine, and maxillary and pre-maxillary graft if necessary.
- A proper repositioning of the lateral crus may necessitate a V-Y advancement of the lateral crus with underlying lining.
- An alternative to V-Y advancement is complete mobilization of the domes and the lateral crus on the cleft side, and rotation anteriorly to match the opposite cleft side without the lining. This will be more successful with bilateral placement of the lateral crura strut.
- It is often necessary to debulk the ala and alar base on the cleft side and reposition the alar base medially.
- It is crucial to remove a crescent-shaped piece of redundant soft triangle lining on the cleft side to aid adjustment of the nostril shape.
- Elongation of the columella is achieved through placement of a columella strut, approximation of the footplates, trimming the soft triangle lining, which will convert the posterior portion of the infratip lobule to the columella, and placement of bilateral alar rim grafts.

In 1931, Blair & Brown called to attention the details of cleft-lip-related nasal deformities.[1] Although Gillies & Millard suggested that repair of cleft lip nose deformity during the primary lip repair is unreasonable, this view has changed dramatically over the years.[2] The initial argument was that, even if the nose is repaired properly during the cleft lip repair, additional surgery would be required at the time of puberty or later. It is often recommended that the operation to correct the skeletal asymmetry of the nose associated with cleft lip deformity is postponed until the age of 16–17.[3] Broadbent & Woolf maintained that noses repaired during infancy will ultimately require additional procedures during adolescence.[4] These strong views convinced most surgeons for decades that the cleft nose frame abnormalities should not be corrected during repair of the cleft lip. From the late 1960s, as pleasing results were produced with more finesse and more accurate alignment of the nasal base structures, convincing evidence was gradually offered to counteract the view opposing early repair of nasal deformity related to cleft lip.

Today, there is almost a consensus among craniofacial and pediatric plastic surgery leaders that correction of nasal tip asymmetry during primary cleft lip repair is advantageous and reduces the potential for additional surgery – or at least diminishes the magnitude of the surgery required as the patient matures. It is, however, crucial to understand that the deficiency in the maxilla inherent in the cleft lip complex disturbs the symmetry of the nose and reduces the support to the base of the nose on the cleft side, notwithstanding what procedures are carried out during the primary repair of the lip. It is therefore sensible to anticipate a secondary rhinoplasty in a number of patients who have undergone repositioning of the nasal frame during the primary surgery,

because abnormal growth and skeletal deficiency will alter the position of the cartilages as the patient reaches adolescence.

Ideally, the secondary cleft lip nose repair should be carried out after the maxillary deficiency has been corrected and the platform that supports the nose has been brought to a proper position and symmetry. This should preferably take place around age 14–15 in a female and 17–18 in a male, when mandibular growth ceases, as documented by cephalometric X-rays. If the maxilla is advanced and the mandible continues to grow, additional maxillary advancement may be required, which can change the shape of the nose. This does not preclude correction of the nose abnormality under any circumstances before age 14–18. In certain cases a secondary cleft rhinoplasty may be deemed appropriate. Especially when the deformity is significant enough to induce psychological or functional disturbances, surgery can be considered earlier. However, the surgeon, the patient, and the family must have a clear understanding that, as skeletal maturation takes place and orthognathic surgery is completed, additional nose surgery may become necessary.

Patient Assessment

In general, cleft lip nose patients who undergo surgery are often pleased with the outcome, are not too fastidious, and do not complain about minor flaws. They are often well-adapted individuals who understand the reality of the deformity that they have to deal with. However, some patients have been the target of peer mockery throughout childhood and adolescence and have developed psychological disturbances that may merit attention prior to surgery. It is therefore essential to make sure that there are no underlying emotional imbalances that might prohibit surgery, since they may lessen or eliminate potential patient satisfaction.

Breathing difficulties should be explored very carefully in such patients, although lack of clinical symptoms does not necessarily mean that the patient does not experience airway occlusion, as indicated earlier. It is important to observe, as in other rhinoplasty candidates, whether the patient is a mouth-breather or mostly breathes through the nose. Additionally, investigation of any history of sinus infections and sinus headaches, which are common in such patients, is important. Learning about any complications that followed the primary repair and subsequent surgeries may help to reduce the potential for them to be repeated. It is also important to find out what tooth extraction and orthodontic work, if any, has been carried out to align the teeth.

On examination of the patient, depending on whether the cleft was unilateral or bilateral and whether or not it involves the alveolar segment and palatal cleft, there will be a great deal of variation in the presentation of the nasal deformity.

BOX 10.1

Features of a Unilateral Cleft Lip Deformity

- Asymmetric tip
- Flattened ala with horizontal orientation of the nostril
- Asymmetric nostril
- Short columella
- Deviated base of the columella to the cleft side
- Lateral crus of the lower lateral cartilage is longer on the cleft side
- Dome is displaced in the frontal and horizontal planes on the cleft side compared to the opposite side
- Nostril is positioned posteriorly because of lack of skeletal support
- There is a lateral displacement of alar base due to reduction of projection of the tip on the affected side
- There is a caudal displacement of the floor of the nose on the cleft side
- Anterior nasal spine and caudal septum are deviated towards the non-cleft side
- Inferior and middle turbinates are hypertrophied
- Often there is a nasolabial or naso-oral fistula
- Maxilla is underdeveloped on the cleft side
- Premaxillary segment is displaced

BOX 10.2

Features of a Bilateral Cleft Lip Deformity

- Flat nasal tip
- Nasal ala flat and S-shaped
- Short columella
- Alar bases are wider than usual
- Nostrils have a more horizontal orientation
- Lateral crura of the lower lateral cartilages are malformed
- Nasal floor is defective and nostril sills are absent
- There are various degrees of septal deviation and turbinate malposition, enlargement and symmetry

There are common shared features of cleft lip nose deformity. Common traits of unilateral cleft lip deformity are listed in Box 10.1 and the presentations of bilateral cleft lip deformity in Box 10.2. Careful observation of the characteristics outlined in these boxes will help to formulate a precise surgical plan. However, it is again crucial to be familiar with abnormalities of the maxilla and mandible that may ultimately influence the outcome considerably. A gratifying outcome for cleft lip rhinoplasty is impossible without correction of the maxillary deficiency and/or excess growth of the mandible.

Nearly 60% of patients who have cleft lip nose deformity have difficulty breathing through the nose.[5] Examination of the oral cavity often reveals occlusal abnormalities or the presence of some type of residual oronasal fistula. It is only after careful evaluation of the entire face that attention can be directed to the nose. Many patients with cleft lip nose deformity have thick skin with overactive sebaceous glands and acne. If acne is present, it should be controlled prior to the nasal surgery.

The nasal bones are commonly asymmetric and very wide. The upper lateral cartilages may be wide, especially in the case of bilateral clefts, where there may be a varying degree of extension of the cleft in the form of divergence of the upper lateral cartilages and nasal bones. The position of the domes and lower lateral cartilages, and therefore the width and projection of the tip, requires careful scrutiny. Assessment of the alar base symmetry may prove difficult because of the malposition and asymmetry of the lip and sometimes deviation of the chin. Observation of the size and orientation of the nostrils, the width of the columella, and the position of the lower lateral cartilages will often reveal a whole range of abnormalities. The architecture of the nostril sill is often distorted: it is commonly flat, scarred, and depressed because there is insufficient bone beneath it.

On the profile view, the radix is frequently shallow. The dorsal profile is often marred by a small hump. The nasolabial angle is usually narrow. The basilar view will disclose a short columella, abnormal orientation of the nostrils, and thickness of the alar base on the cleft side. The nostril sill and the floor can be more readily assessed in this view. Internal examination of the nose may often divulge some degree of stenosis, collapse of the external and internal valves, deviation of the septum, and presence of synechiae or even septal perforation.

Surgical Correction

The majority of cleft lip rhinoplasties are performed under general anesthesia. The approach is similar to that described in Chapter 4. The key to a successful correction of the cleft lip nose deformity is proper exposure and identification of the skeletal asymmetries and restoration of support to the tip. Local anesthetic is again injected in two sessions, initially using xylocaine containing 1:200 000 epinephrine and subsequently xylocaine containing 1:100 000 epinephrine, ropivacaine hydrochloride, and hyaluronidase (150 U/ml of injectable material). In the rare procedures that take longer than 2 hours, a second injection becomes necessary to induce more sustained vasoconstriction.

An open approach through a mid-columellar incision (Figure 10.1) is almost invariably preferred, except for a minor revision that can successfully be undertaken using a closed technique. However, most surgeons, even those who routinely perform non-cleft rhinoplasties through an endonasal approach, prefer an external approach for cleft lip rhinoplasty. The rationale is that the asymmetry is so substantial that it is often difficult, if not impossible, to produce sufficient improvement using the endonasal approach.

Although the nature of the surgery varies tremendously from patient to patient, the majority have a small dorsal hump that must be removed. Most of the surgery above the tip is similar to that performed in non-cleft patients.

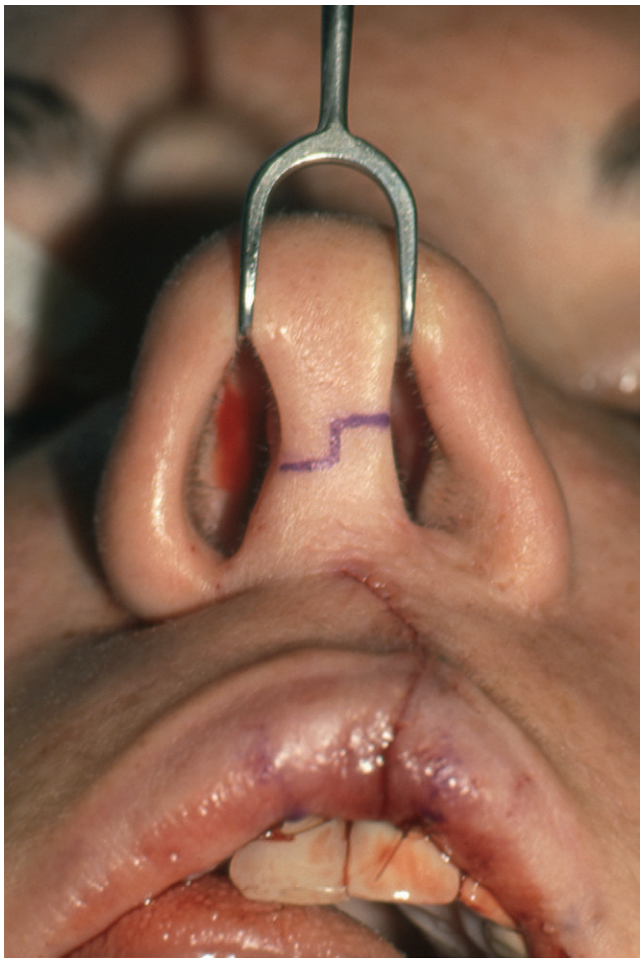

Figure 10.1 Design of a columellar incision in a cleft lip nose patient.

Figure 10.2 Dissection of the lower lateral cartilages demonstrating significant asymmetry.

As mentioned above, patients with cleft lip nose deformity may have nasal bone asymmetry and may therefore require a differential treatment of the nasal bones. Furthermore, the bones may be too far apart, and their approximation may necessitate removal of a wedge of bone between the midline and the lateral portion of the nasal bones. The upper lateral cartilages may require separation from the midline and repositioning with varying thicknesses of spreader grafts or flaps, especially if the dorsal hump is large. Separation of the upper lateral cartilages from the midline provides an opportunity to perform a thorough septoplasty, which is often necessary. It is crucial to reposition the septum properly, since many patients have airway compromise. After completion of the septoplasty, a turbinectomy, as described in Chapter 4, may be carried out if necessary. Doyle stents are applied and sutured in place.

The basilar surgery is more demanding. This is largely because of the magnitude of the frame asymmetry inherent in patients with unilateral cleft lip nose deformity, and soft tissue abnormalities induced by longstanding frame deformities. The basic tenets for correcting a unilateral cleft lip rhinoplasty

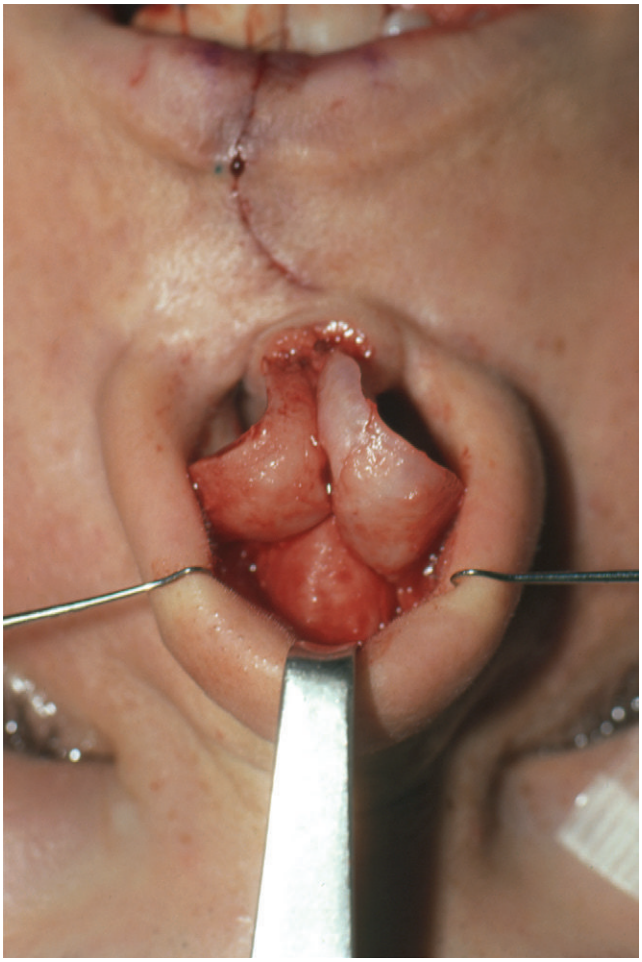

Figure 10.3 The cephalic view demonstrating malposition of the lower lateral cartilages.

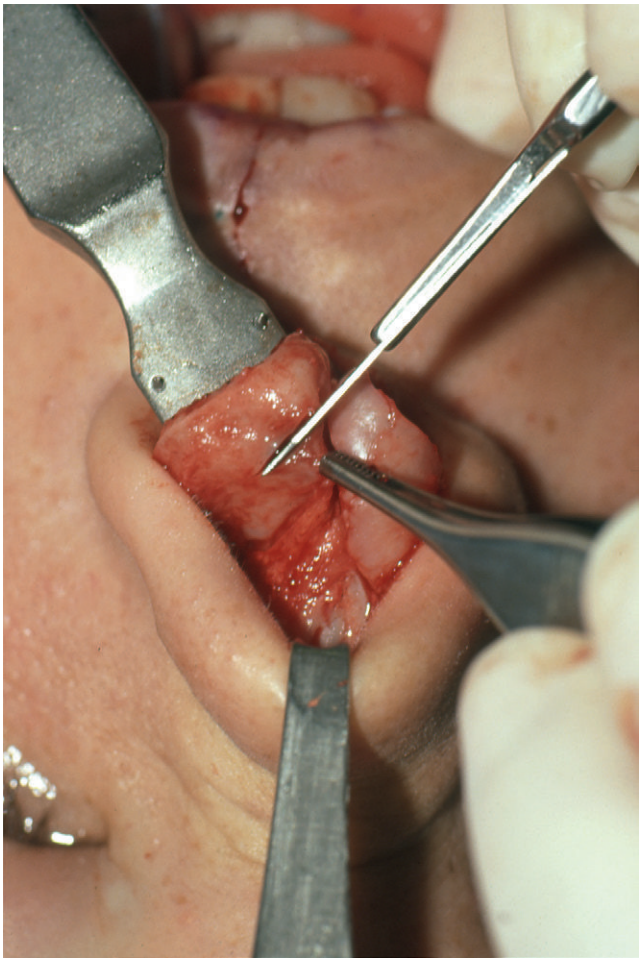

Figure 10.4 Removal of the cephalic margin of the lower lateral cartilages.

include complete exposure of the lower lateral cartilages, which often unveils a significant asymmetry (Figure 10.2), especially on the cleft side (Figure 10.3), removal of the cephalic margin of the lower lateral cartilages (Figure 10.4), removal of excessive soft tissue between the domes to create better definition (Figure 10.5), and dissection of the lateral crura of the lower lateral cartilage as far laterally as possible for repositioning. A septoplasty is carried out through an open technique as indicated above (Figure 10.6) and septal cartilage is harvested which is invariably necessary. An important step in correcting the cleft lip nose deformity is augmentation of the nasal spine and premaxillary area, placement of a strong columella strut (Figures 10.7–10.9), and approximation of the footplates of the medial crura to the columella strut using PDS sutures (Figure 10.10). This consistently requires anterior advancement of the medial crus on the cleft side. It is essential to match the domes as closely as possible intraoperatively. This may necessitate a V–Y type advancement of the lateral crus with the underlying lining to rotate the lateral crus of the lower lateral cartilage medially. The advantage of keeping the nasal lining

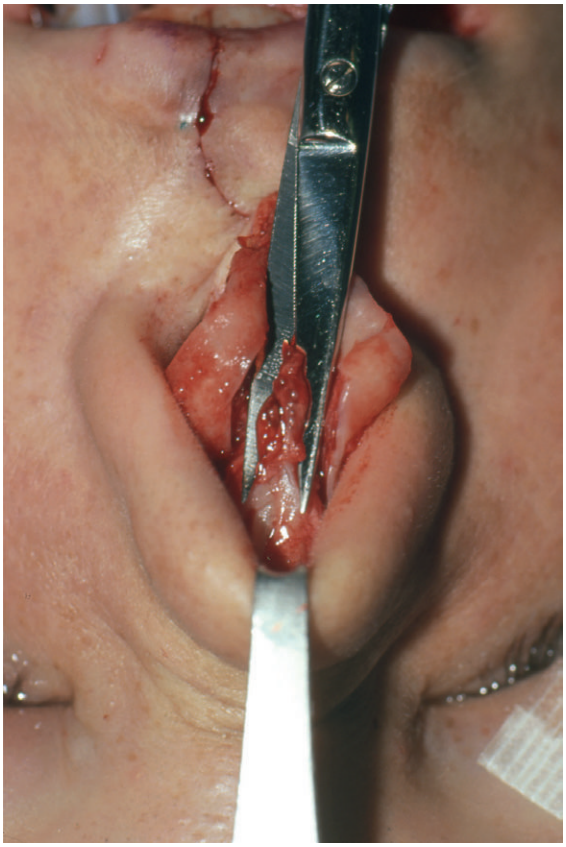

Figure 10.5 Removal of excessive soft tissue between the domes to create better definition.

Figure 10.6 A septoplasty, if necessary, is performed using an open technique.

Figure 10.7 The domes are aligned to tattoo across the medial crura for symmetrical placement of the sutures when the columella strut is inserted.

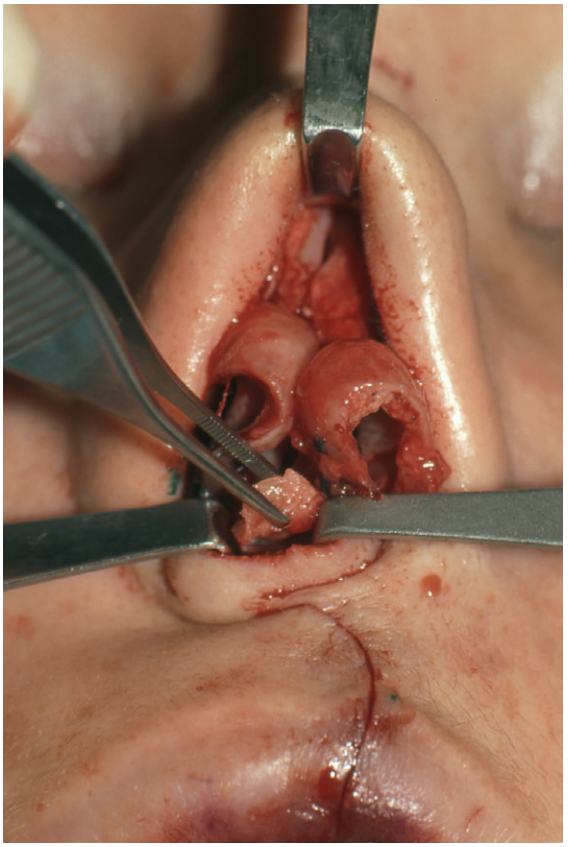

Figure 10.8 Placement of an anterior nasal spine graft to create more fullness at the base of the columella.

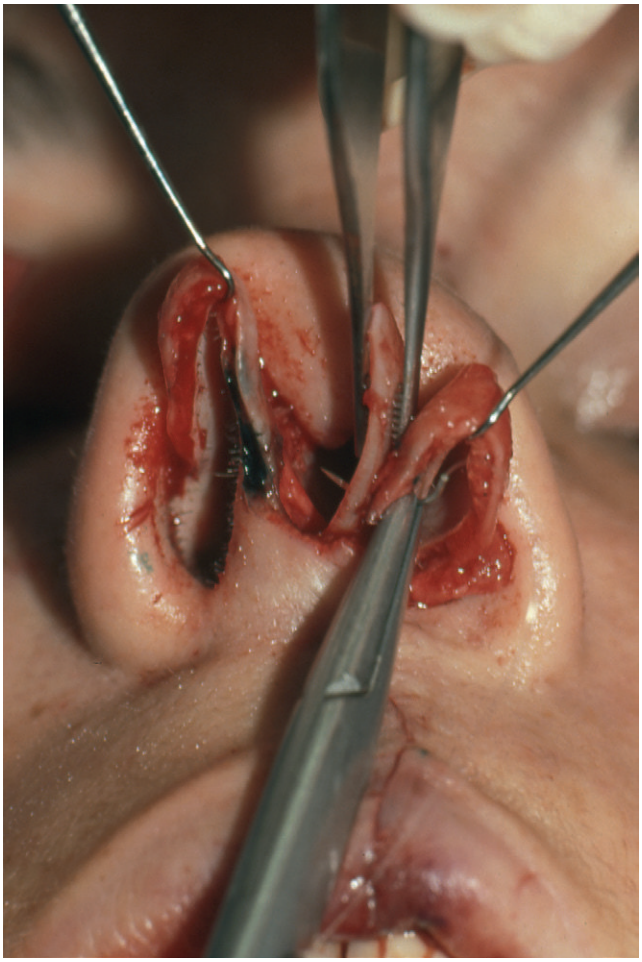

Figure 10.9 Placement of a columella strut.

Figure 10.10 The medial crura are approximated through the columella strut. Note the redundant left soft triangle lining, which will be trimmed to the level of the domes, and that the domes are still not leveled perfectly.

attached to the advanced lateral crus is that it will raise the nostril on the affected side, which is invariably posteriorly and caudally malpositioned. This composite tissue is sutured to a strong columella strut. A V–Y advancement will be strongly indicated if there is a tendency for the tip to shift to the cleft side, in order to prevent the soft tissues from pulling the domes to the affected side. Alternatively, one can complete mobilization of the dome and the lateral crus on the cleft side and rotate them anteriorly to match the non-cleft side. This would be more successful with bilateral placement of a lateral crural strut. Additionally, there is almost invariably extra thickness in the alar base on the cleft side, which should be reduced. Internal and external simple stents, as described in Chapter 11, are applied and fixed in position using through-and-through sutures of 5-0 polypropylene to eliminate the dead space within the thickness of the ala. This, along with application of a nostril stent at the end of the surgery, will invariably restore the nostril symmetry intraoperatively. However, this symmetry may change during healing if a nose stent is not used for a long enough period of time postoperatively.

Figure 10.11 A shield graft is sutured in position to achieve better tip projection and symmetry.

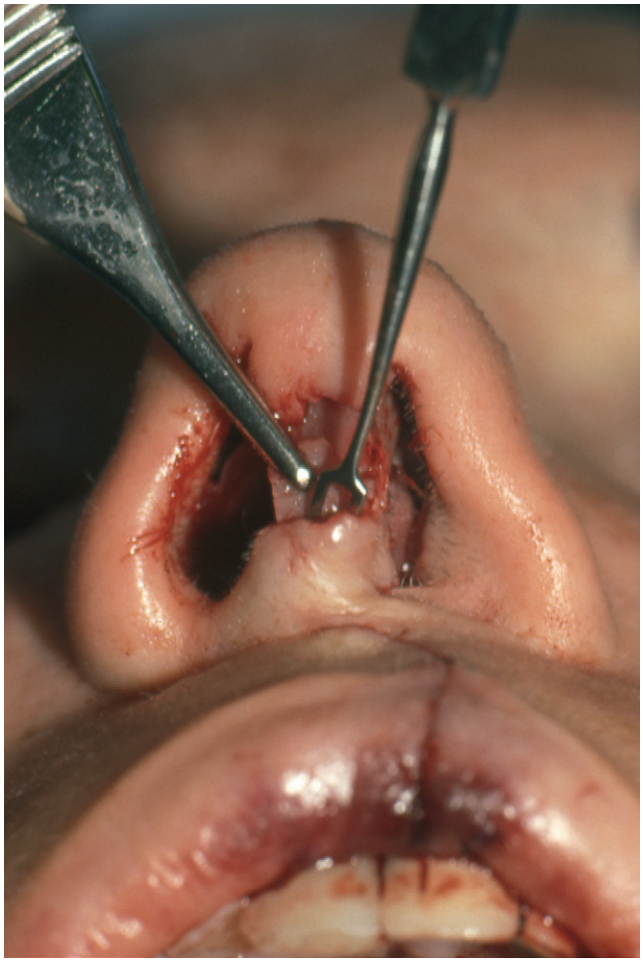

Figure 10.12 An additional graft is applied in the anterior nasal spine area if necessary.

The tip structures are then further strengthened and greater symmetry is achieved by application of a shield graft, which is sutured to the newly realigned domes, if necessary (Figure 10.11). This ensures that, over time, scar formation will be less likely to shift the domes, and creates more enduring tip symmetry. An additional onlay graft is applied to the anterior nasal spine, if required, to improve the angle between the columella and the lip (Figure 10.12).

The excess fibrofatty tissue above the domes is removed, if necessary, and a supratip suture, as described for primary rhinoplasty (Chapter 4) and noses with thick skin (Chapter 16) is applied (see Video 4.24 in Chapter 4) to eliminate the dead space and create better supratip definition.

After completion of the realignment of nasal tip structures, one more crucial step is necessary to match up nostril size. A majority of patients with unilateral cleft lip deformity have excess soft tissues in the soft triangle area.

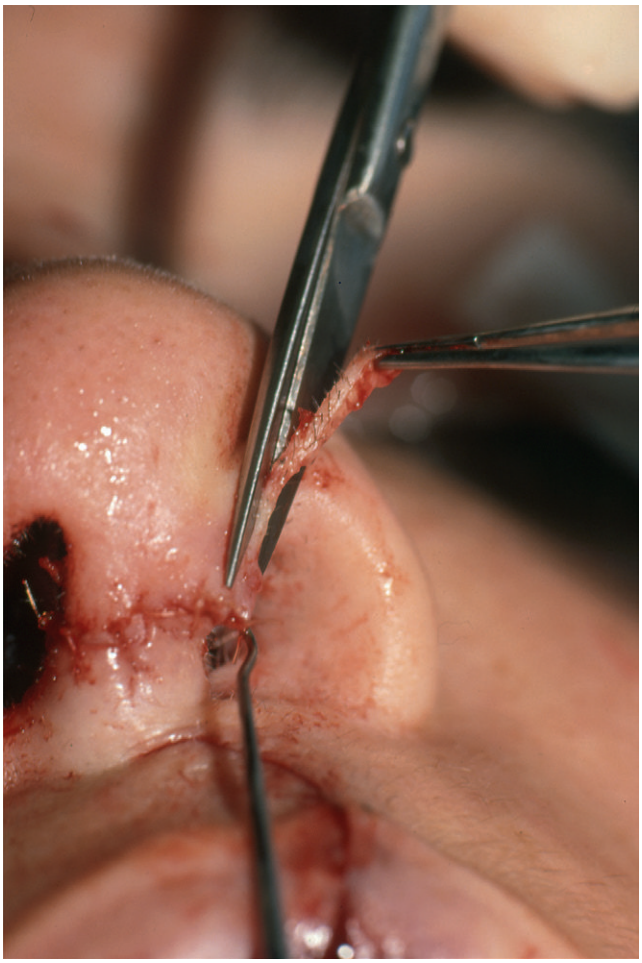

Figure 10.13 The redundant soft triangle lining is being removed.

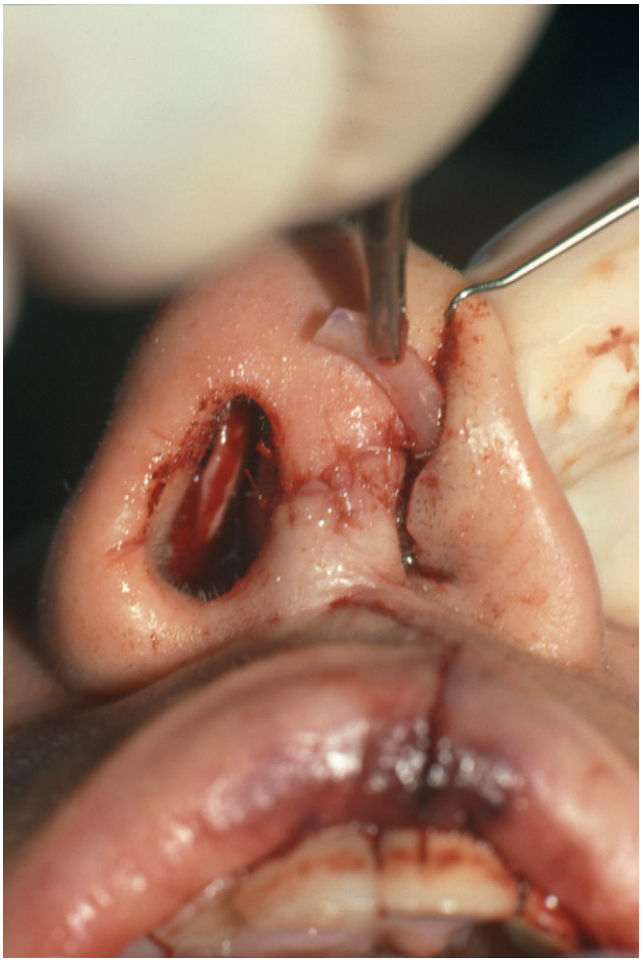

Figure 10.14 An alar rim graft is invariably necessary to create a better rim configuration.

Without excision of a crescent piece of the soft triangle lining, as detailed in Chapter 13, reorientation of the nostrils and achievement of symmetry may not be possible (Figure 10.13). After the excess soft triangle lining is excised, bilateral alar rim grafts are applied (Figure 10.14) and the alar rim incision is repaired under the newly repositioned dome using 6-0 fast absorbable catgut. This will reposition the nostril anteriorly and ensure more symmetry. The columella incision is then repaired as well, using 6-0 fast absorbable catgut. If there is a deficiency in the nostril sill area, a cartilage graft is tailored and placed in the site through an alar base incision. In essence, a platform is created to emulate the missing nostril sill. An external and internal simple splint is placed and sutured in position using through-and-through sutures tied loosely to minimize necrosis of the skin (Figure 10.15). Almost invariably, the base on the cleft side is wider than the normal side, which is corrected via an incision in the alar/facial crease (Figure 10.16). The goal is to create as much symmetry between the two sides as possible (Figures 10.17, 10.18; Animation 10.1; Box 10.3).

Animation 10.1•

Figure 10.15 A simple stent is placed and sutured in position using through-and-through sutures to eliminate the dead space.

Figure 10.16 The alar base redundancy is excised.

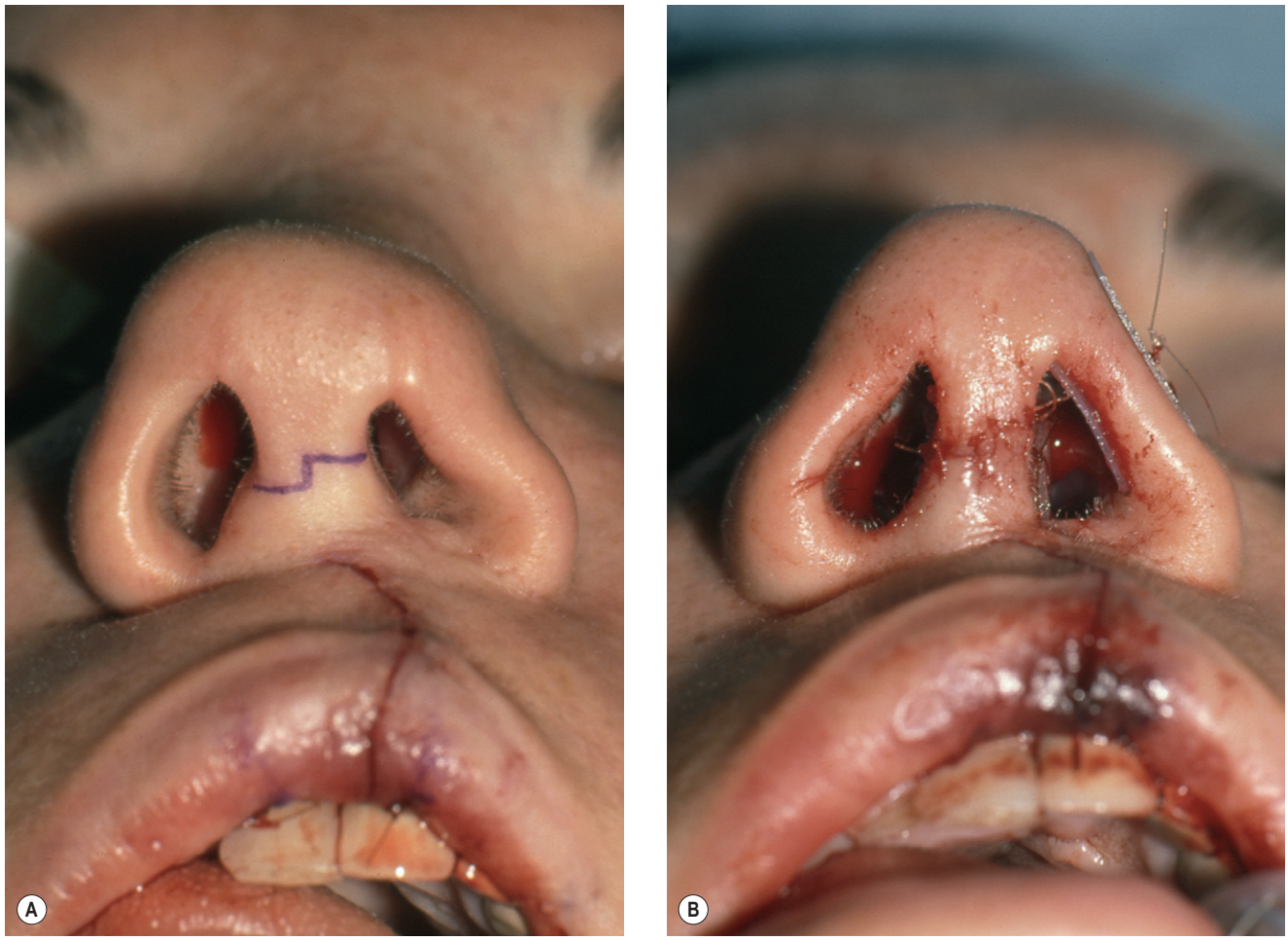

Figure 10.17 Creation of a narrower, symmetric tip, thinner ala, and a more symmetric alar base is demonstrated intraoperatively.

Figure 10.18 A patient before (A, C, E, G) and 5 years after (B, D, F, H) rhinoplasty for a unilateral cleft lip related nose deformity. The illustrations demonstrate the soft tissue (I) and frame alterations (J) to achieve the intended goals.

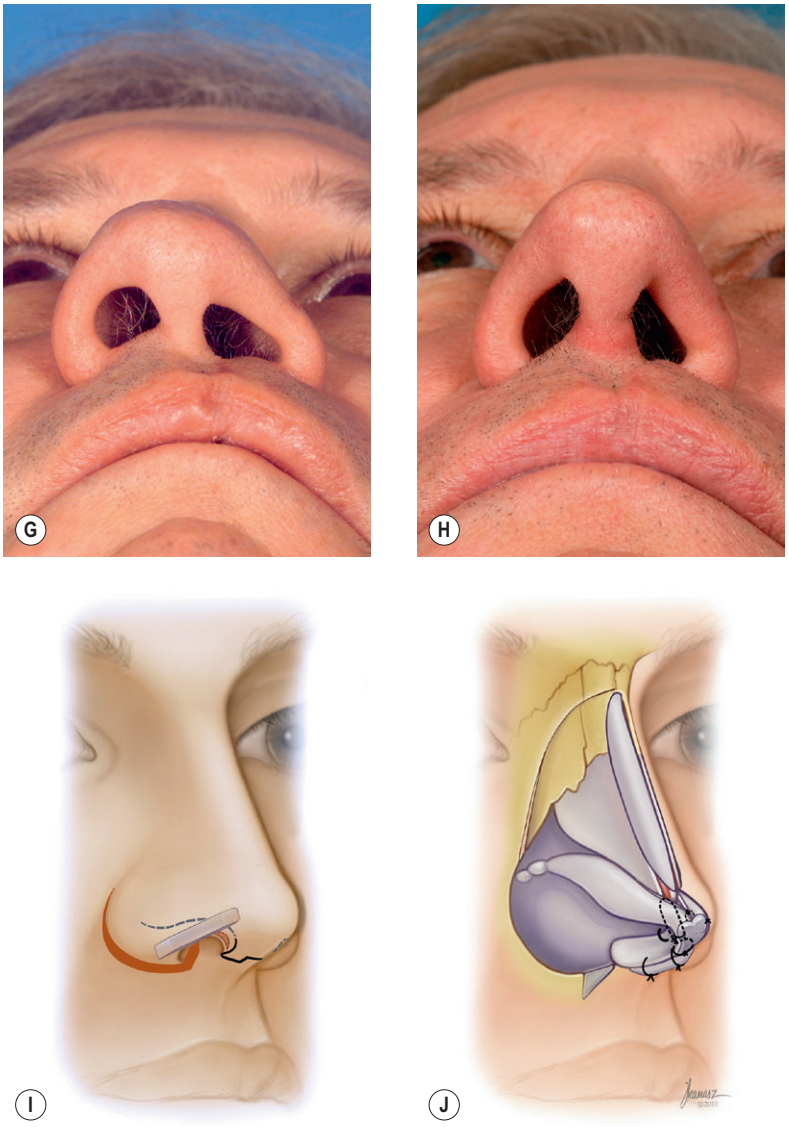

Figure 10.18, cont'd.

BOX 10.3

Surgical Steps: Figure 10.18

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was performed
- A low-to-low osteotomy was carried out bilaterally
- A bilateral lateral osteotomy was carried out
- A columella strut was applied
- A figure-of-eight interdomal suture was placed
- An onlay tip graft was applied
- Supratip soft tissue was removed
- The alar bases were narrowed bilaterally using combined excision
- The soft triangle lining was excised bilaterally in a crescent shape
- The upper lateral cartilages were approximated to the septum

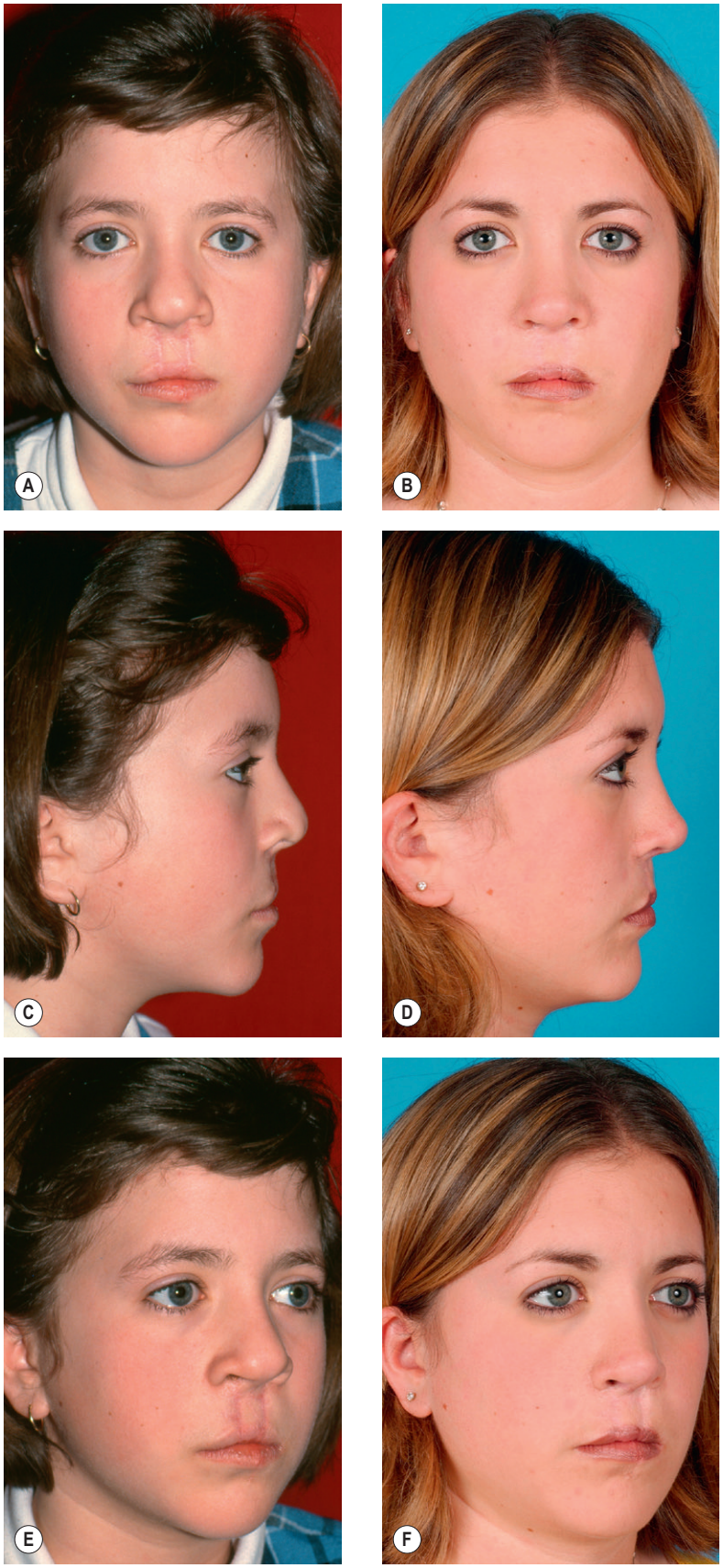

Figure 10.19 A patient with bilateral cleft lip related nose deformity before (A, C, E, G) and 9 years after rhinoplasty (B, D, F, H). The illustrations demonstrate the soft tissue (I) and frame alterations (J) to achieve the intended goals.

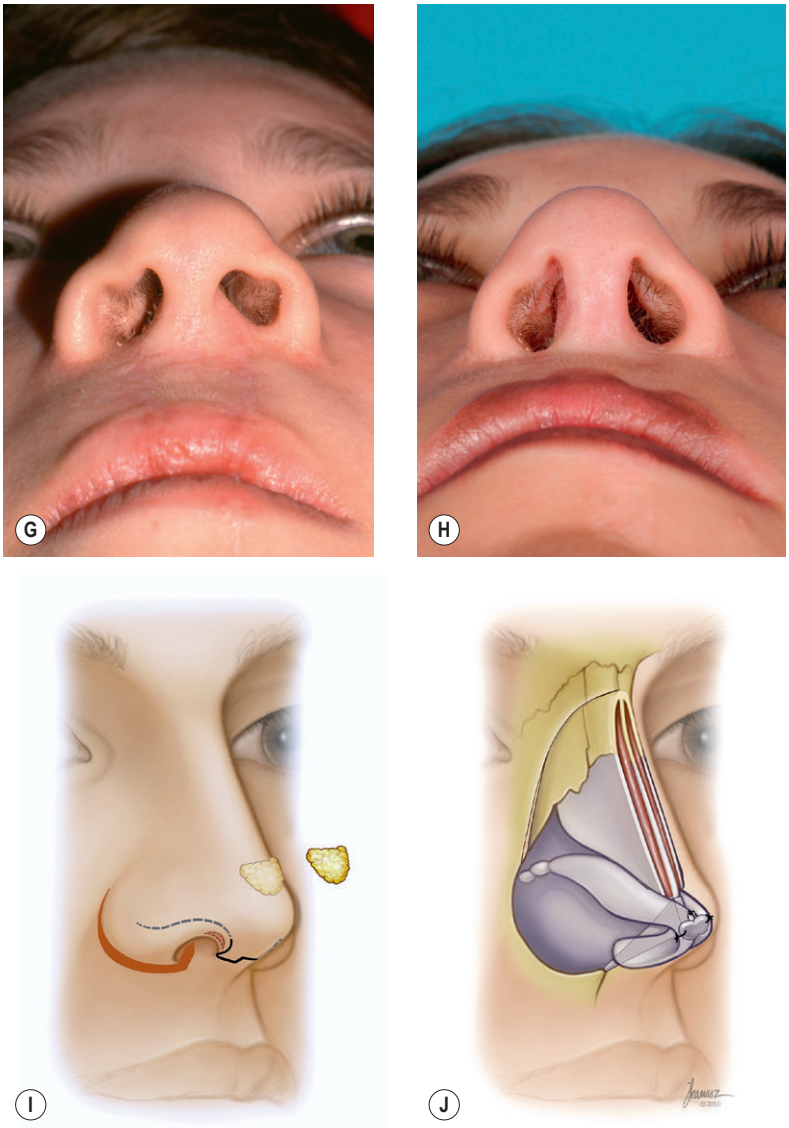

Figure 10.19, cont'd.

The major challenge in correcting bilateral cleft lip nose deformity is elongation of the columella. This is achieved through placement of a columella strut, approximation of the footplates, trimming the soft triangle lining, which will convert the posterior portion of the infratip skin to the anterior vestibular lining elongating the nostril and columella, and placement of bilateral alar rim grafts. Patients with bilateral cleft lip often require bilateral alar base reduction (Figure 10.19; Animation 10.2).

Animation 10.2•

If an osteotomy has been performed, the nose is splinted for 8 days and the Doyle stents are removed in 4–5 days. The patient is instructed not to wear glasses for about 5 weeks.

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CHAPTER 11

Correction of Alar Rim Deformities

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Animations

Correcting Alar Retraction Animation 11.1

Pearls

- The optimal ala–columella relationship on the profile requires a symmetric oval outline of the nostril in conjunction with the columellar base that is bisected by the line connecting the most anterior and posterior ends of the nostril.
- Ideally, there is 3–4 mm columellar show caudal to the alar rim. Increased distance cephalad to the bisection line is an indication of an alar retraction, while an increase caudally is a reflection of columella protrusion. A decrease in this distance caudally is an indication of columella retraction, and a decreased distance cephalically may denote a hanging ala.
- Concavity of the ala may exist as a result of natural weakness, over-resection of the lower lateral cartilage, or cephalic malpositioning of the lower lateral cartilages.

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- A lateral crura spanning suture, a transdomal suture, or a combination of these can also result in a concave ala.
- To correct the hanging ala, an ellipse is designed within the vestibular lining. The lining and the underlying fibrofatty tissues are excised, and fast absorbable 6-0 catgut is used to repair the defect.
- Alar thickness can be reduced by removing an elliptical piece of soft tissue as far medially along the caudal border of the alar rim as possible.
- Alar convexity can be effectively corrected with a transdomal suture, lateral crura spanning suture, or lateral crura convexity control suture.
- Mild to moderate alar rim retraction can be corrected by placement of an alar rim graft.
- An effective means of correcting alar retraction is a V-Y advancement of the alar lining along with placement of an alar rim graft.
- It is commonly necessary to add internal and external splints to eliminate the dead space and ensure proper advancement of the alar rim.

One of the hallmarks of an 'operated nose' is the residual or iatrogenic disharmony of the alar rim or exaggeration of existing, uncorrected flaws in the alae. In order to correct alar imperfections, it is crucial to detect the dysmorphology and to understand the pathology causing it.

Gunter et al introduced a classification of alar rim deformities, which was further amended by the author's team.[1,2] Some of these deformities are only visible on the profile view and some are discernible on the basilar view. The optimal ala–columella relationship on the profile requires a symmetric oval outline of the nostril in conjunction with the columella base that is bisected by the line connecting the most anterior and posterior ends of the nostril. Ideally, there is a maximum of 3–4 mm columellar show caudal to the alar rim, which means that the distance between the bisection line and the alar rim is approximately 1.5–2.0 mm (Figure 11.1A). Increased distance cephalad to the bisection line is an indication of an alar retraction, while an increase caudally is a reflection of columella protrusion (Figure 11.1B). A decrease in this distance caudally is an indication of columella retraction, and a decreased distance cephalically may denote a hanging ala (Figure 11.1C). An increase in the distance caudal to the line denotes a hanging columella. The basilar view (Figure 11.2) of the ideal nose demonstrates an equilateral triangle outline with symmetric positioning of the ala tangential to the limbs of the triangle (Figure 11.2A). Concavity of the ala within the triangle may exist as a result of natural weakness, over-resection of the lower lateral cartilage or cephalically malpositioned lower lateral cartilages. A lateral crura spanning suture, a transdomal suture that is placed cephalad through the cartilages, or a combination of these elements may also produce a concave ala (Figure 11.2B). This deformation of the ala imparts a clover leaf shape to the base of the nose, which is aesthetically very displeasing. Domes that are too wide because of lateral extension of the convex lower lateral cartilages

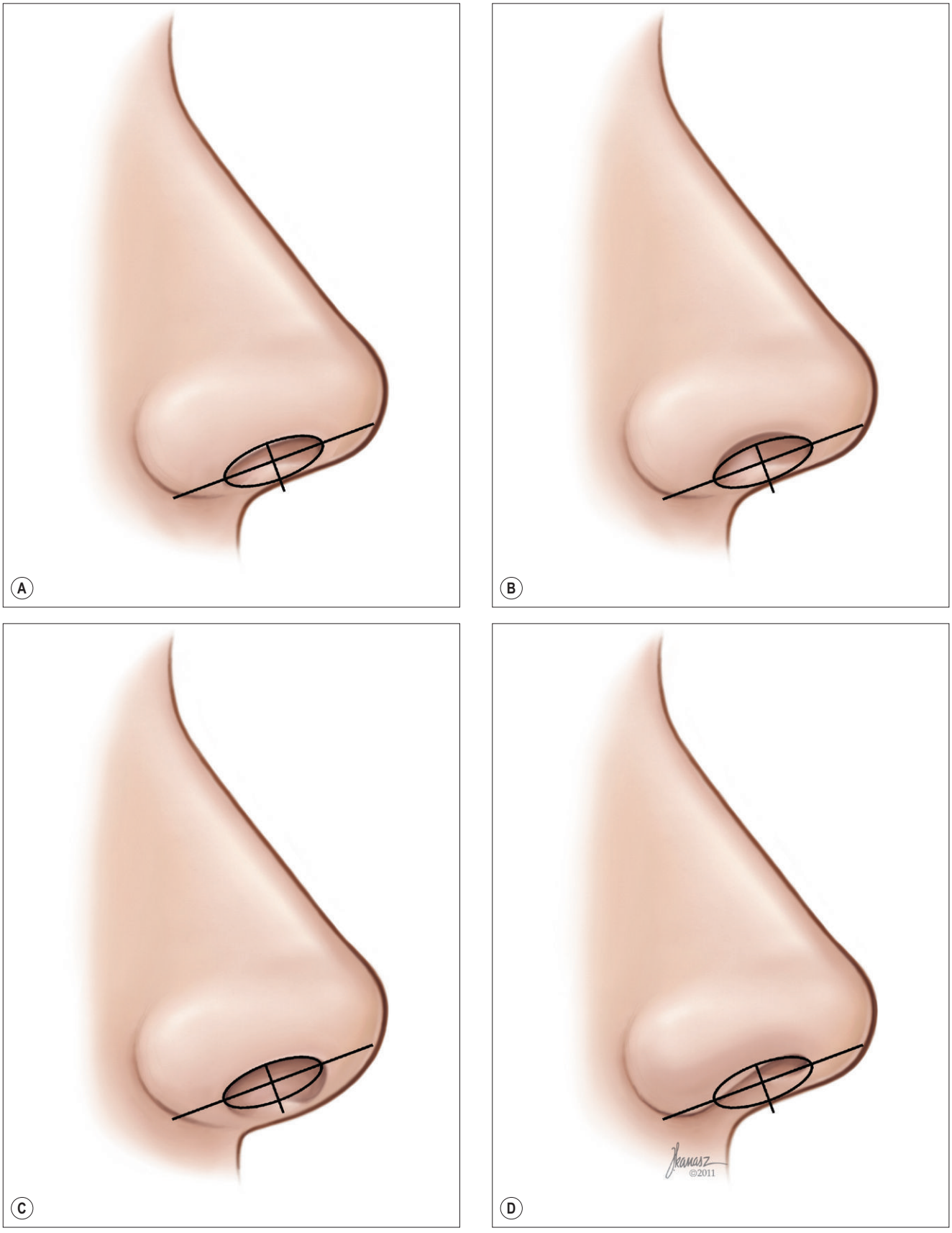


Figure 11.1 Gunter/Rohrich classification of alar deformities on the profile view. (A) An ideal ala–columella relationship creates a symmetrical, oval outline on profile view bisected by a line connecting the most anterior to the most posterior portion of the nostril with a maximum 2 mm distance from the ala and columella to this line. (B) When this distance is increased cephalically, there is a retracted ala. (C) When the distance is decreased, there is a hanging ala. (D) Increase in the distance caudally results in excess columellar show.

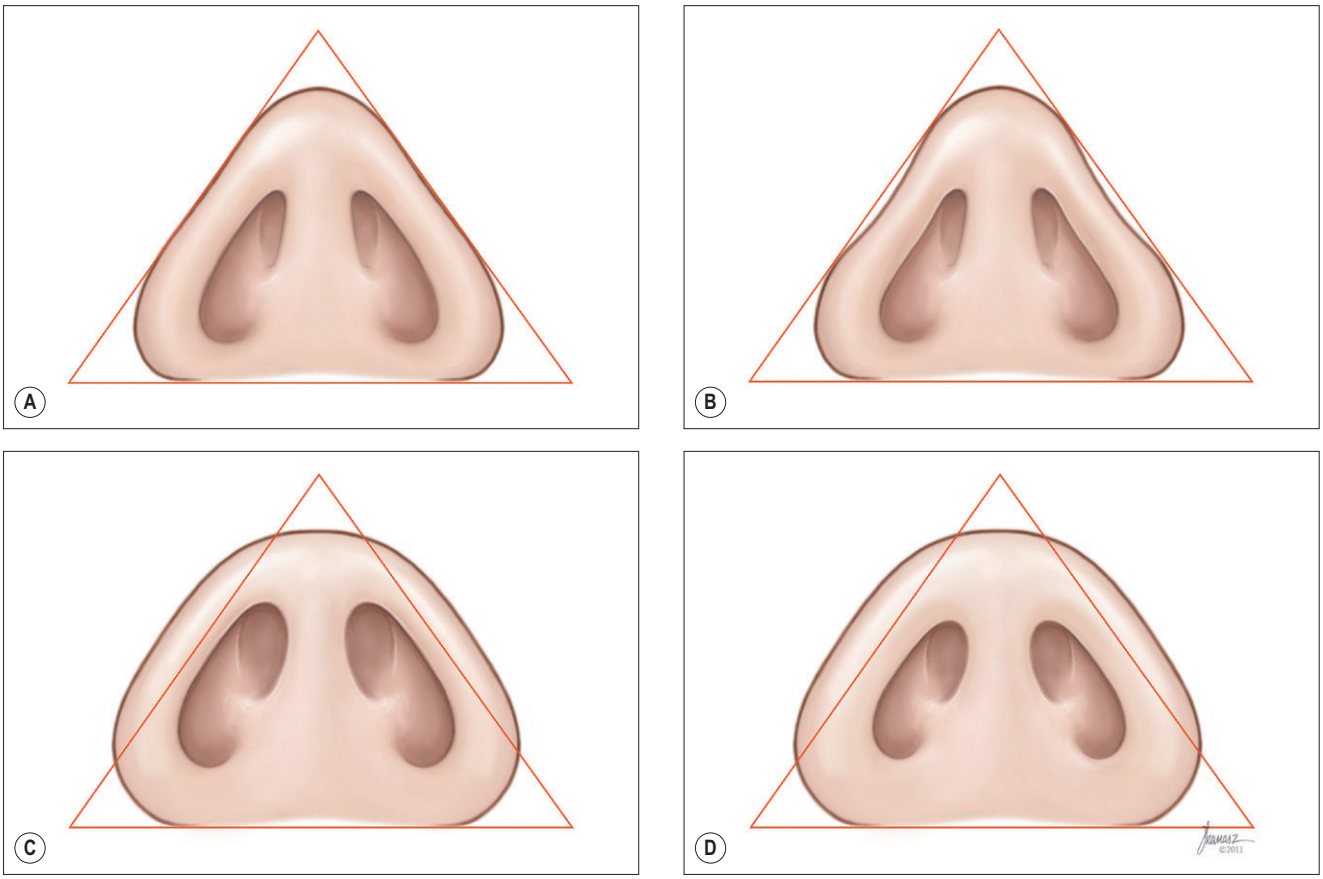


Figure 11.2 (A) In a basilar view, an ideal nose is confined within an equilateral triangle. (B) A weak lateral crus creates concavity (clover leaf deformity). (C) Wide domes with convex lower lateral cartilages extend the ala beyond the triangle. (D) Extension of the ala beyond the triangle may be the consequence of a thicker ala.

can stretch the nostrils outside the triangle. This type of alar morphology is typical of African-American and Asian noses, in which the nostril wall has a normal thickness but extends beyond the optimal nasal base triangle (Figure 11.2C). Significant reduction of tip projection may also cause such a change. Additionally, excessive thickness of the lateral nasal wall can broaden the basilar outline of the nose beyond the triangle (Figure 11.2D). The notching or retraction of the ala can be classed as minimal, moderate, or severe and each may benefit from a different corrective approach.

Correction of Hanging Ala

This condition is the consequence of excessive soft tissue in the ala.[3] It is corrected through excision of an elliptical piece of lining with as much associated deep subcutaneous soft tissue as possible, without violating the external skin. An ellipse is designed within the nasal lining. The nasal lining and the

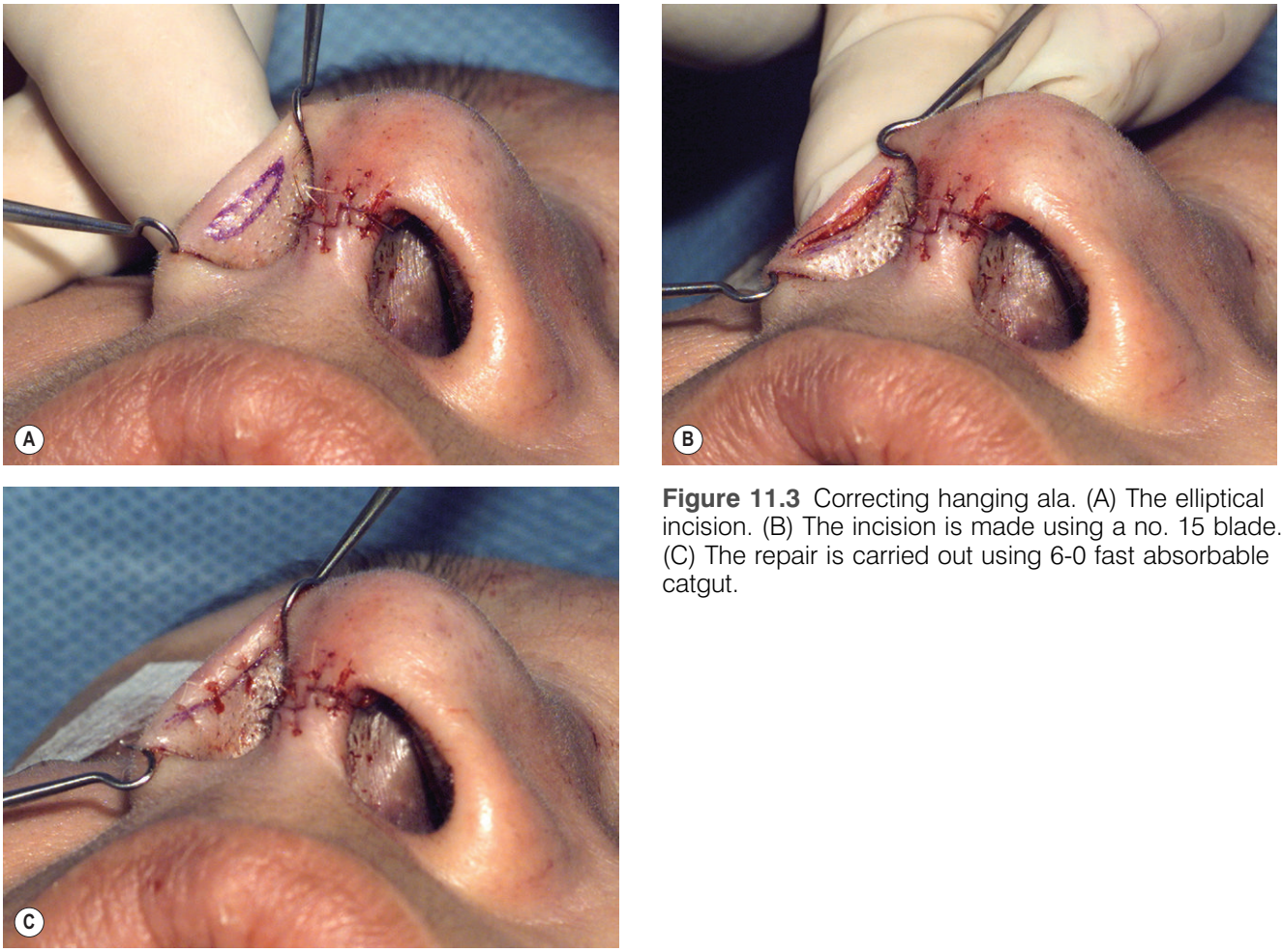


Figure 11.3 Correcting hanging ala. (A) The elliptical incision. (B) The incision is made using a no. 15 blade. (C) The repair is carried out using 6-0 fast absorbable catgut.

underlying fibrofatty tissues are excised, and fast absorbable 6-0 catgut is used to repair the incision (Figure 11.3).

Correction of Thick Ala

Elimination of the thickness of the ala can be accomplished in one of two ways. If the alar base needs to be narrowed,[4] one may be able to remove a portion of the soft tissues within the lateral wall of the nostril (Figure 11.4A) and place simple stents (made by Supramed) on either side to eliminate the dead space and prevent recurrence of the thickness. The details of application of the simple splint will be described later in this chapter. The other option is to remove a portion of the thickness of the lateral wall of the nostril using an elliptical incision at the caudal surface of the alar rim (Figure 11.4B). The skin along the caudal border of the rim, as close to the lining as possible, and the soft tissues within the lateral wall of the nostril are excised (Figure 11.4C). The elliptical incision is repaired using 6-0 fast absorbable catgut sutures (Figure 11.4D).

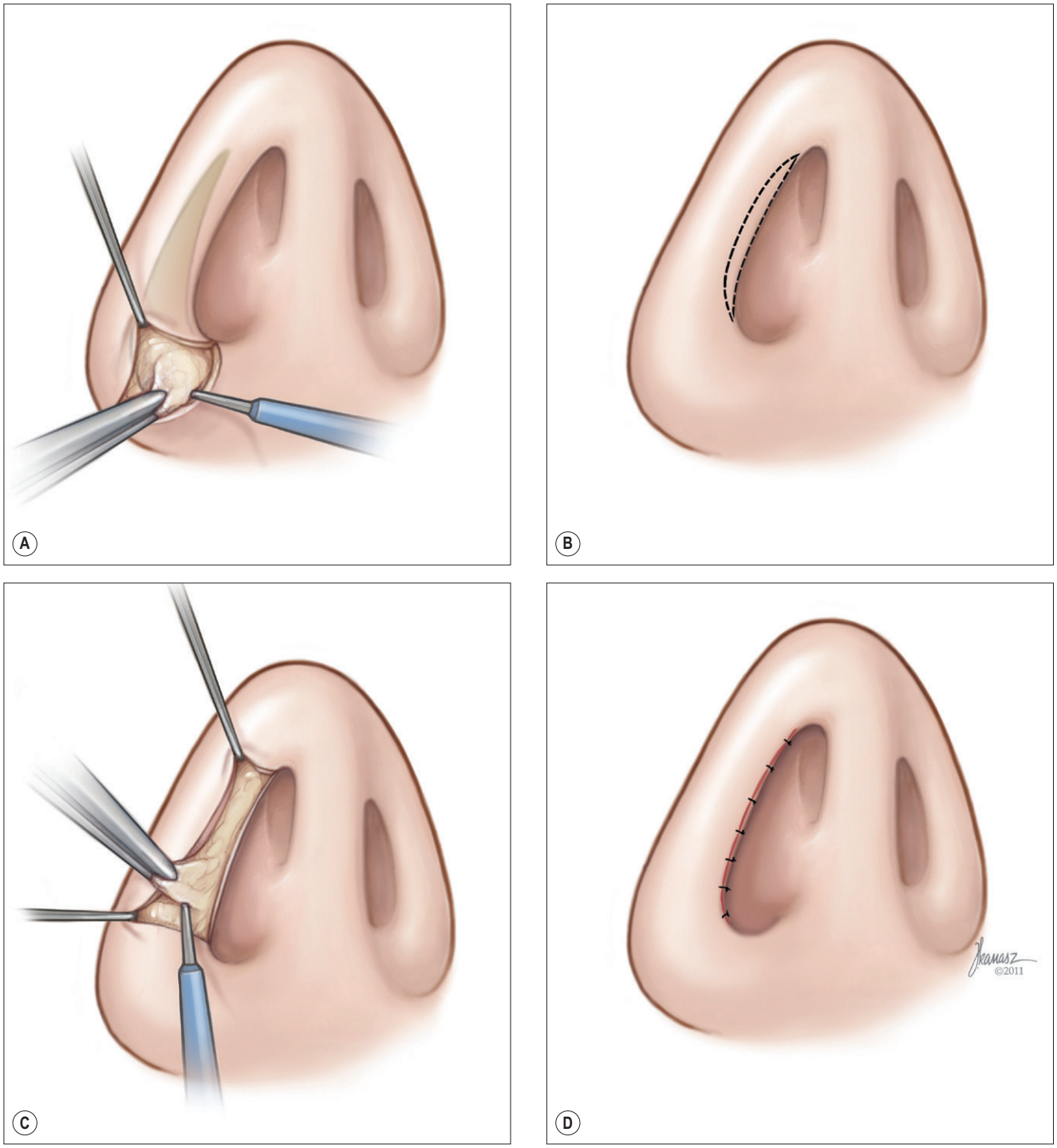


Figure 11.4 (A) Debulking the ala through the alar base, as described by Matarasso.[4] (B) An elliptical incision is made at the caudal surface of the alar rim (C) The skin along the caudal border of the rim, as close to the lining as possible, and the soft tissues within the lateral wall of the nostril are excised. (D) The incision is repaired using 6-0 fast absorbable catgut.

Correction of Alar Concavity

This deformity can be easily corrected by placement of an alar rim graft, described below. Additionally, a lateral crus strut, as described by Gunter and Friedman, can predictably correct this deformity.[5]

Correction of Alar Convexity

This deformity is very effectively corrected with a transdomal suture, lateral crura spanning suture, or lateral crura convexity suture, described by Gruber et al[6] (Figure 11.5).

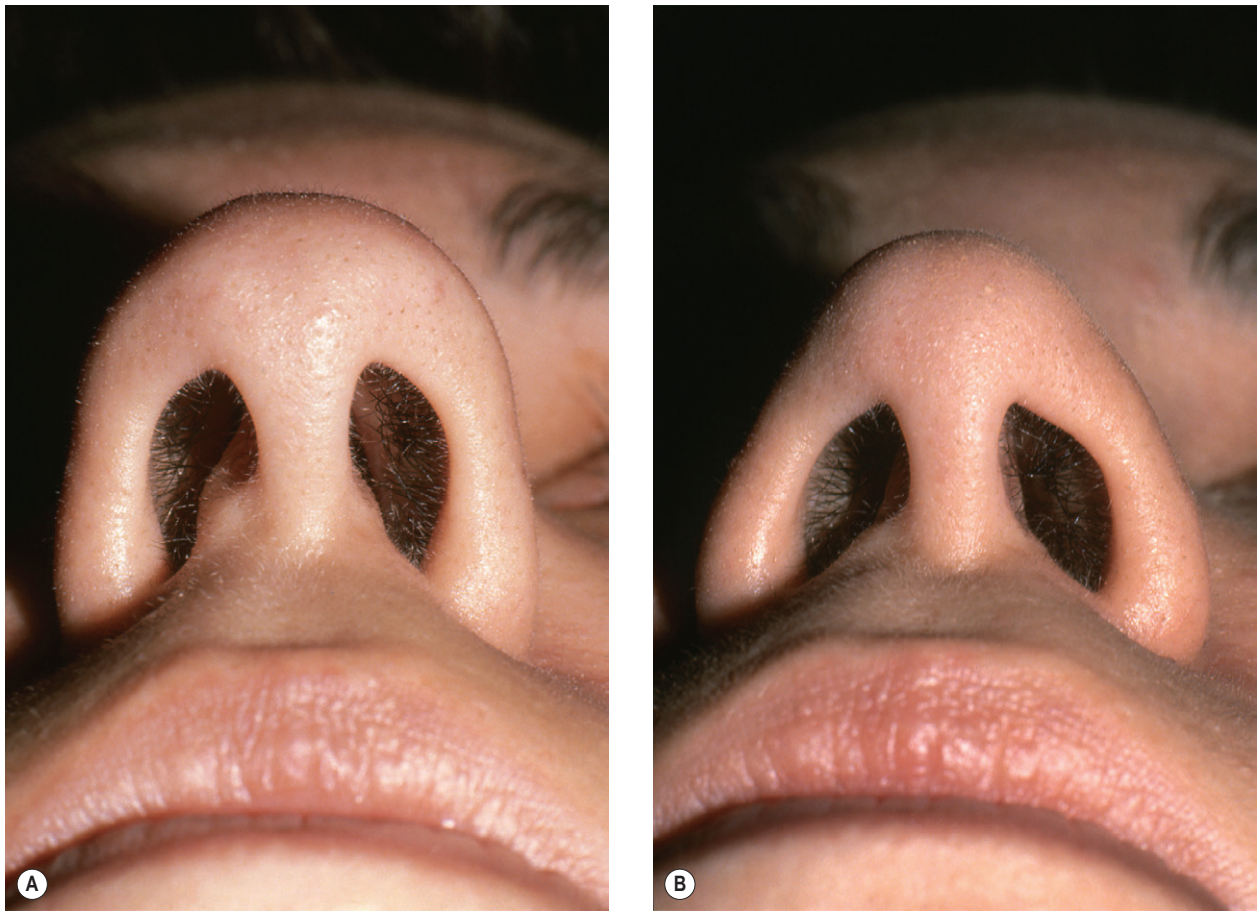


Figure 11.5 Basilar view of convex lateral crura before (A) and after (B) correction.

Correction of Alar Retraction

This abnormality is often the consequence of placement of sutures such as transdomal and lateral crura spanning sutures, dome interruption techniques, excessive removal of the lateral crus of the lower lateral cartilages, or malposition of this cartilage. There are four ways in which this abnormality can be corrected.

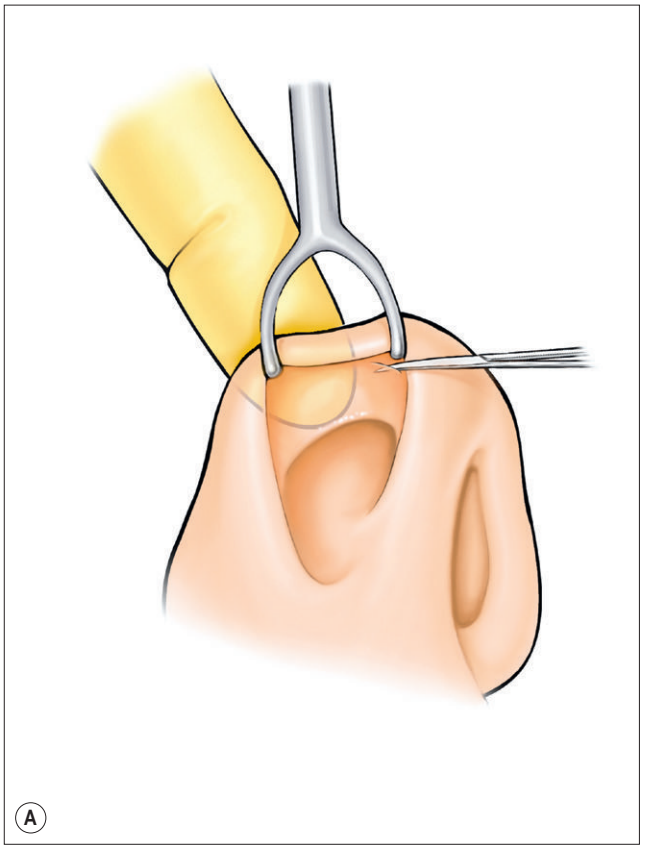
For mild or moderate retraction, placement of an alar rim graft is often sufficient. This can be carried out using a closed or open technique. If the correction of the alar rim is the sole purpose of the surgery and no other procedure is planned to mandate an open technique, the correction can be accomplished through a small rim. After injection of the ala with xylocaine containing 1:100 000 epinephrine, an incision is made in the most anterior portion of the lateral crus parallel to the rim (Figure 11.6A; Animation 11.1). A pair of iris scissors is utilized to create a pocket as close to the alar rim as possible using a spreading technique without any cutting. A piece of cartilage measuring 13–15 mm long and 3 mm wide is prepared. The anterior end of the cartilage is beveled and the caudal end is rounded to facilitate its insertion. The graft is advanced in position (Figures 11.6B, C). The pocket is increased in size incrementally to accommodate the graft, if necessary. The anterior end of the graft should stop short of the most projected portion of the dome to avoid inadvertent widening of the tip. The graft is sutured in position using 6-0 fast absorbable catgut (see Video 4.25 from Chapter 4).

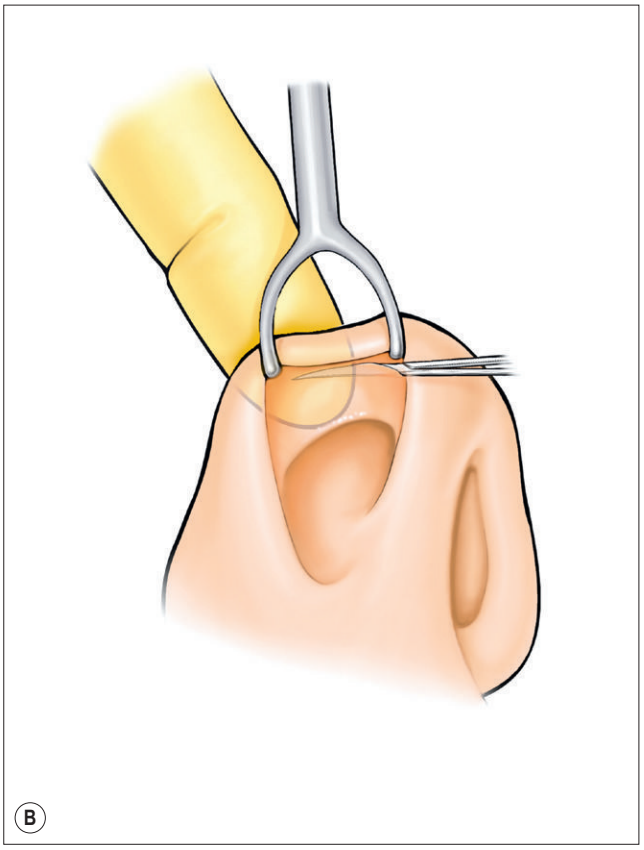
Animation 11.1 •

A minor retraction of the ala is also automatically corrected with alar base reduction when the alar base is too wide. As the alar base is narrowed through excision of the nostril sill and the lateral segment is sutured to the medial segment, the alar rim is also repositioned caudally and the retraction is reduced.

Another option for correction of mild to moderate retraction is placement of a lateral crura strut, which is discussed in Chapter 19. Again, this can be carried out using a closed or open technique. The challenge is finding a properly sized, straight piece of cartilage. A pocket is created between the mucoperichondrium and the lateral crus and the cartilage graft, ideally from the septum or the rib, is inserted in position and fixed to the overlying lateral crus using 6-0 poliglecaprone sutures. An open technique can facilitate insertion of the graft and ensures better symmetry. However, this procedure can be carried out via an endonasal approach without much difficulty.

When the retraction is significant, two choices are available. One is the use of a composite graft.[7] First, an incision is made in the vestibular lining and the rim is dissected and moved caudally to the ideal position. The size of the resultant defect is measured precisely. A composite graft is harvested from the conchal fossa including the skin and the underlying cartilage. The graft is placed in position and sutured circumferentially using 6-0 fast absorbable





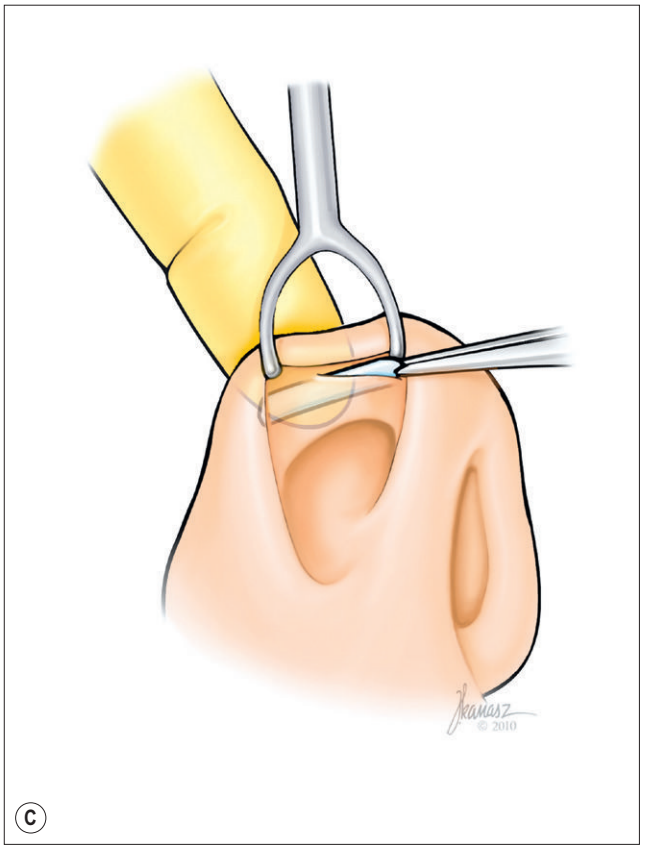


Figure 11.6 Correcting alar retraction. (A) An incision is made along the alar rim anteriorly. (B) A pocket is created with a pair of iris scissors. (C) A piece of cartilage 13–15 mm long and 3 mm wide is inserted into the pocket.

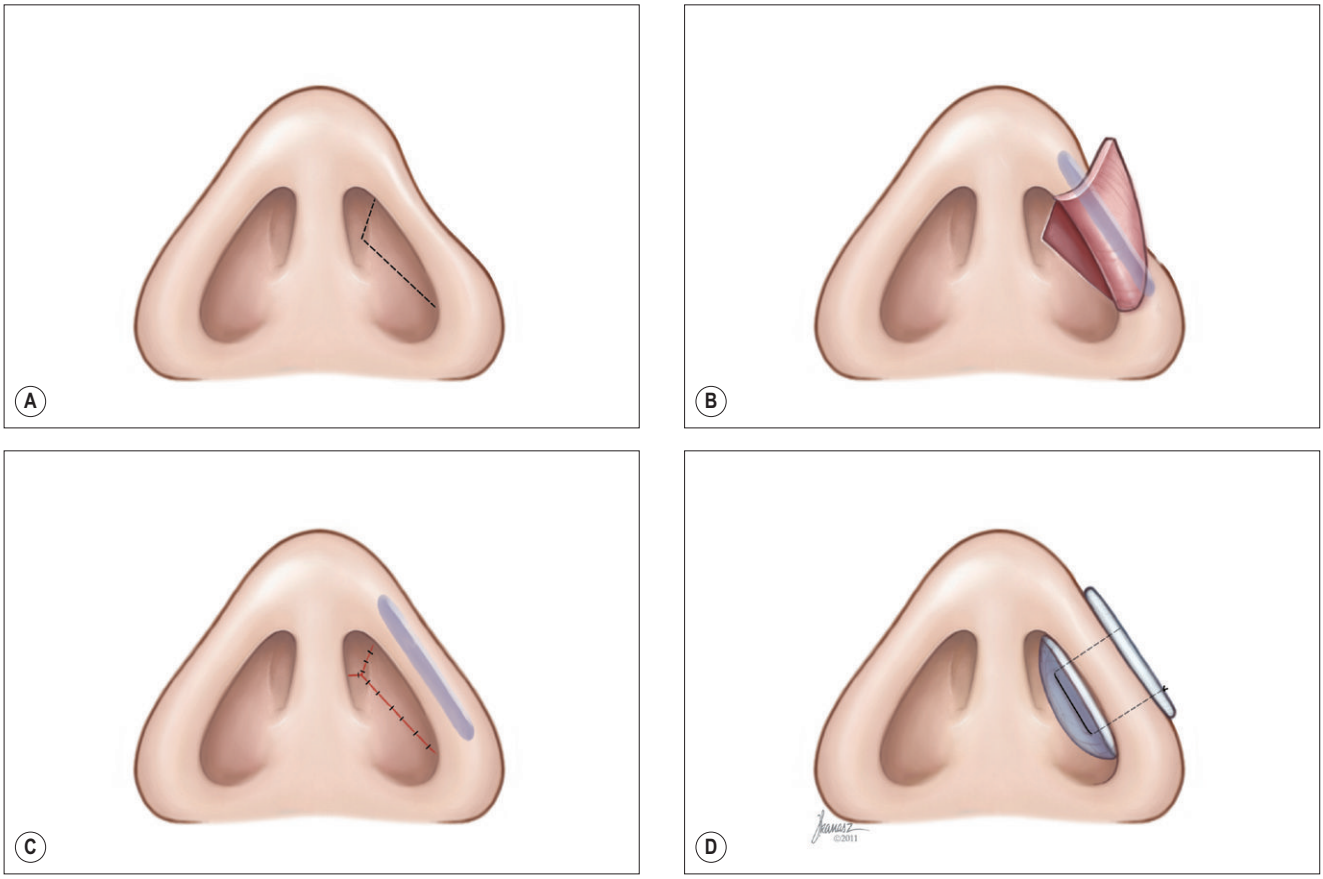


Figure 11.7 V–Y advancement to correct alar retraction. (A) The design of the V incision. (B) Elevation of the flap. (C) The V–Y advancement is performed after placement of an alar rim graft. (D) A simple stent is placed internally and externally and sutured in place.

catgut. Use of simple stents internally and externally, as will be described for the V–Y advancement, will help minimize excessive thickening of the ala. The donor site can commonly be repaired by undermining and advancing the skin over the defect using 5-0 plain catgut.

Another very effective technique for correction of alar rim retraction is a V–Y advancement).[2] This involves the design of a flap based along the alar rim. The incision will start from the posterior and anterior margins of the alar rim and extends to the intercartilagenous line (Figure 11.7A). A lining flap is elevated without violating the integrity of the external skin (Figure 11.7B). The flap is reflected caudally and carefully dissected to the alar rim (Figure 11.7C). An alar rim graft is placed in position and the flap is rolled caudally. A V–Y advancement is achieved with closure of the incision cephalically with one or two stitches of 5-0 chromic. A few additional sutures are placed to repair the rest of the Y incision (Figure 11.7D). Simple stents are then applied on either side of the ala and fixed in position using 5-0 polypropylene through-and-through sutures. This will eliminate the dead space and will

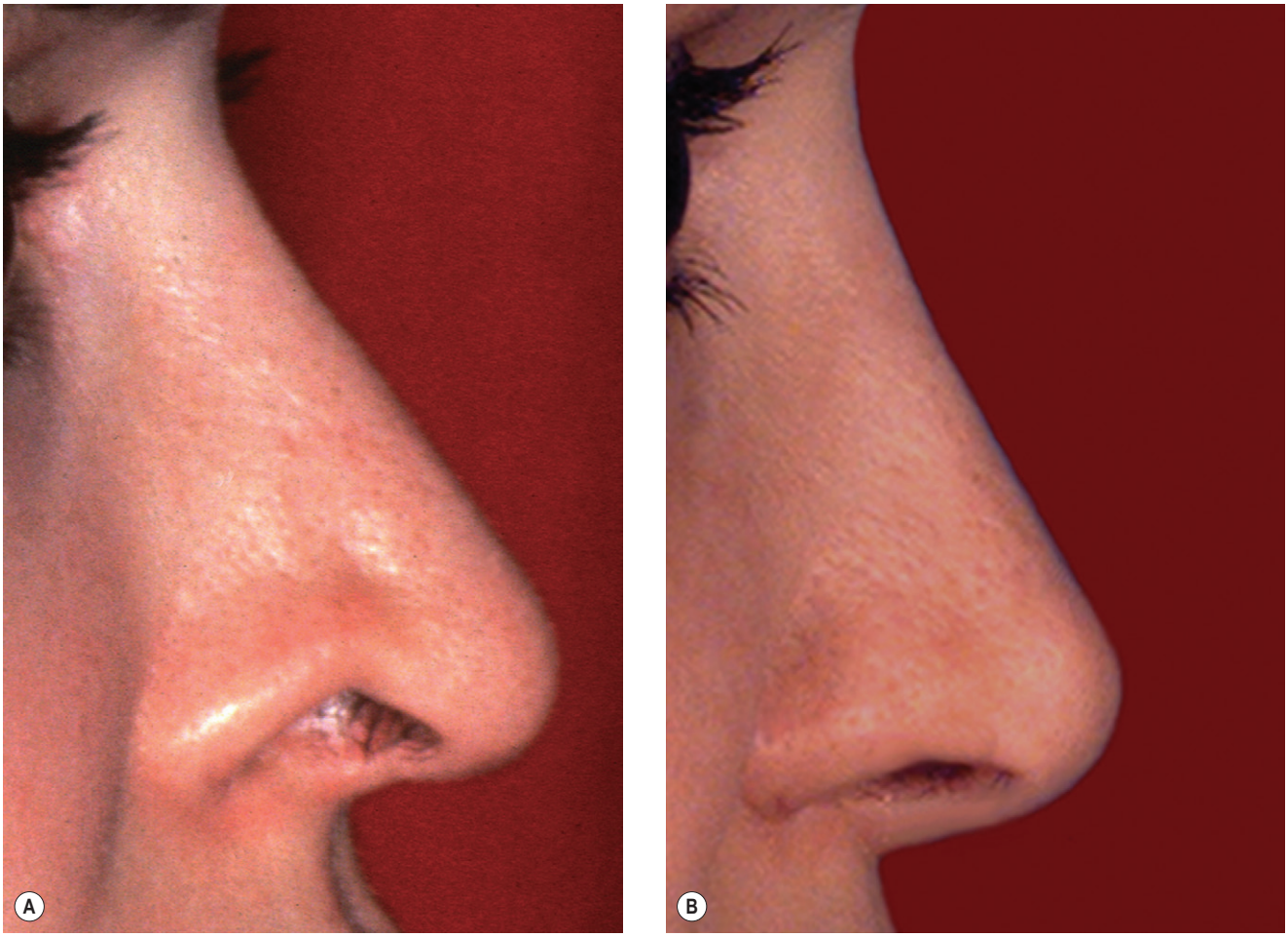


Figure 11.8 Before (A) and after (B) correction of alar rim deformity with a V–Y advancement.

often facilitate rolling the alar rim caudally. This is the most reliable way to correct an alar rim retraction without the need for a lining graft (Figure 11.8). The V–Y advancement can be done in conjunction with an open technique. The incision on the ala will incorporate a V flap in the design (Figure 11.9).

Correction of Excess Columellar Show

Sometimes the alar/columella disharmony is related to excessive columellar show rather than alar retraction. The solution here is to remove a rectangular piece of the protruding caudal septum along with a proportional amount of the membranous septum. This will effectively retract and improve the position of the columella (Figure 11.10).

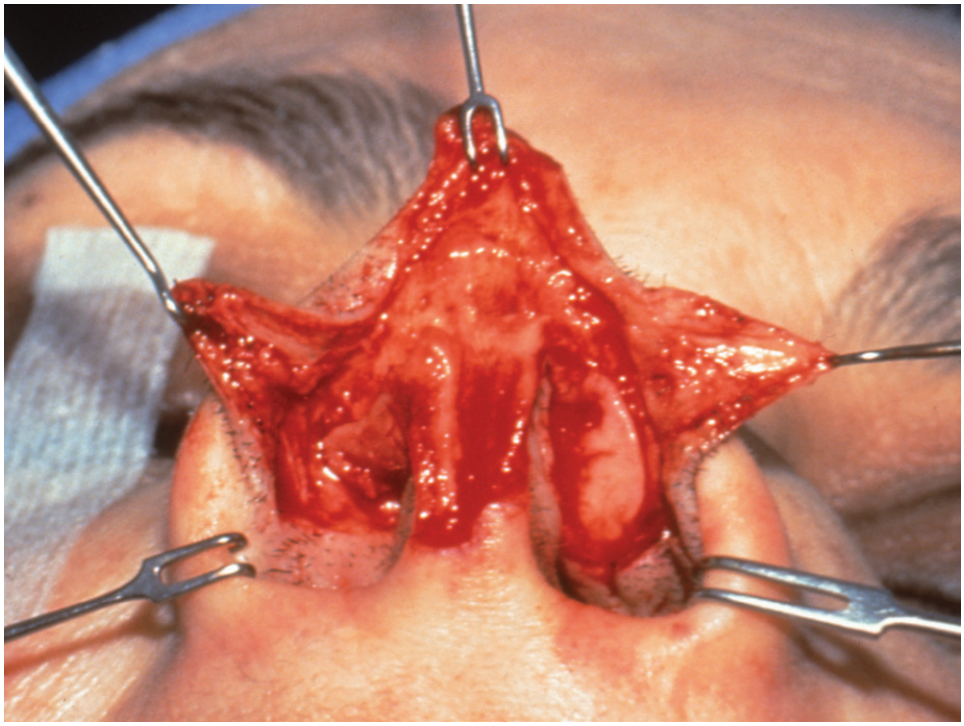


Figure 11.9 The V–Y advancement can be carried out using an open technique. The incision in the ala incorporates a V flap in its design.

Figure 11.10 Removal of a rectangular piece of protruding caudal septum with a proportional amount of membranous septum and placement of alar rim graft has effectively retracted the columella and advanced the ala in this patient with a combination of alar retraction and hanging columella.

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CHAPTER 12

Alar Base Surgery

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Animations

Pearls

- Alar base incongruity can manifest as flaring of the nostrils with a wide alar base, alar base asymmetry, or an alar base that was improperly reduced causing an undesirable angulation and notching at the base of the ala.
- The alar base can also be malpositioned vertically, being either too cephalad or too caudal.

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- The horizontal excess can be the result of a wide alar base, a thick alar base or a wide nostril sill, each of which will require a different type of surgical correction.
- A combination of horizontal and vertical excess or deficiency may coexist.
- When correcting the alar base excess related to the wide nostril sill, the incision is designed with almost parallel limbs at the nostril sill tapering laterally to the alar-facial crease.
- To eliminate the excess alar base width related to redundant nostril sill and wide alar base laterally, a combination of nostril sill and base excision is conducted using an elliptical incision.
- The lateral alar base excess is eliminated by designing an elliptical incision that is solely on the lateral portion of the alar base without extension to the nostril sill or the vestibular lining. The posterior limit of the incision will be placed in the alar-facial groove.
- The thick alar base is thinned and narrowed with an L-shape or crescent excision.
- An alar base can also be secondarily widened as a result of maxillary advancement or significant reduction of the tip projection which often requires a sill or combined excision.
- Moderate to severe cephalic malposition of the alar base is corrected by removal of an elliptical piece of skin from the upper lip, full mobilization of the ala, and caudal transposition of the alar base.
- If placement of an alar rim graft is intended, it should be inserted before alteration of the alar base since it can widen the nostril to some degree.

An imbalanced alar base is a common feature of an 'operated nose'.[1–3] This incongruity may manifest as flaring nostrils with a wide alar base that was not corrected during the primary rhinoplasty, alar base asymmetry, or, even worse, an alar base that was improperly reduced, thus eliminating the graceful transition from ala to nostril sill and causing a displeasing angulation at the junction of the alar base with the upper lip. This deformity can be difficult to correct. It is therefore essential to evaluate prudently the alar base abnormalities and plan the surgical correction with the utmost precision in order to avoid these undesirable outcomes. Additionally, understanding the dynamic interplays germane to the alar base surgery is absolutely crucial. This portion of the rhinoplasty should not be considered trivial and the role that the alar base surgery plays in the success of rhinoplasty is greater than is usually realized.

Anatomy and Pathology

Recognition of alar base disharmony is the most important step in establishing a pleasing relationship between the base, the rest of the nose, and the

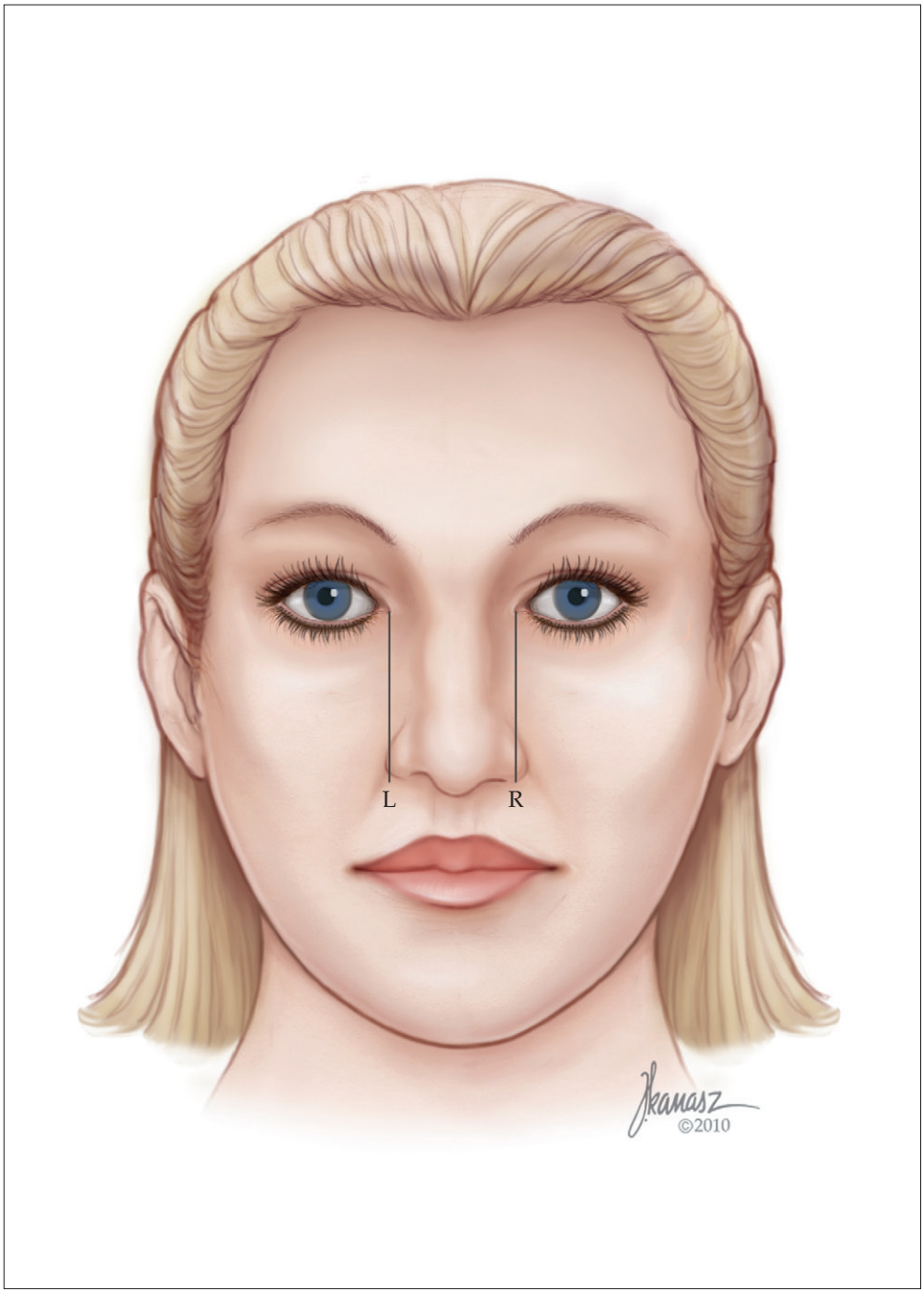


Figure 12.1 Two vertical lines (lines L and R) should pass 1 mm medial to the outer boundary of the optimally positioned alar base (as long as the intercanthal distance is normal).

face. The distance from the lateral limits of one alar base to the opposite side is approximately 2 mm wider than the intercanthal distance in a harmonious face. This is true as long as the intercanthal distance is optimal (normally 31–33 mm; Figure 12.1). Should the intercanthal distance be judged to be abnormal, the orbital fissure (the distance from the medial to lateral canthus)

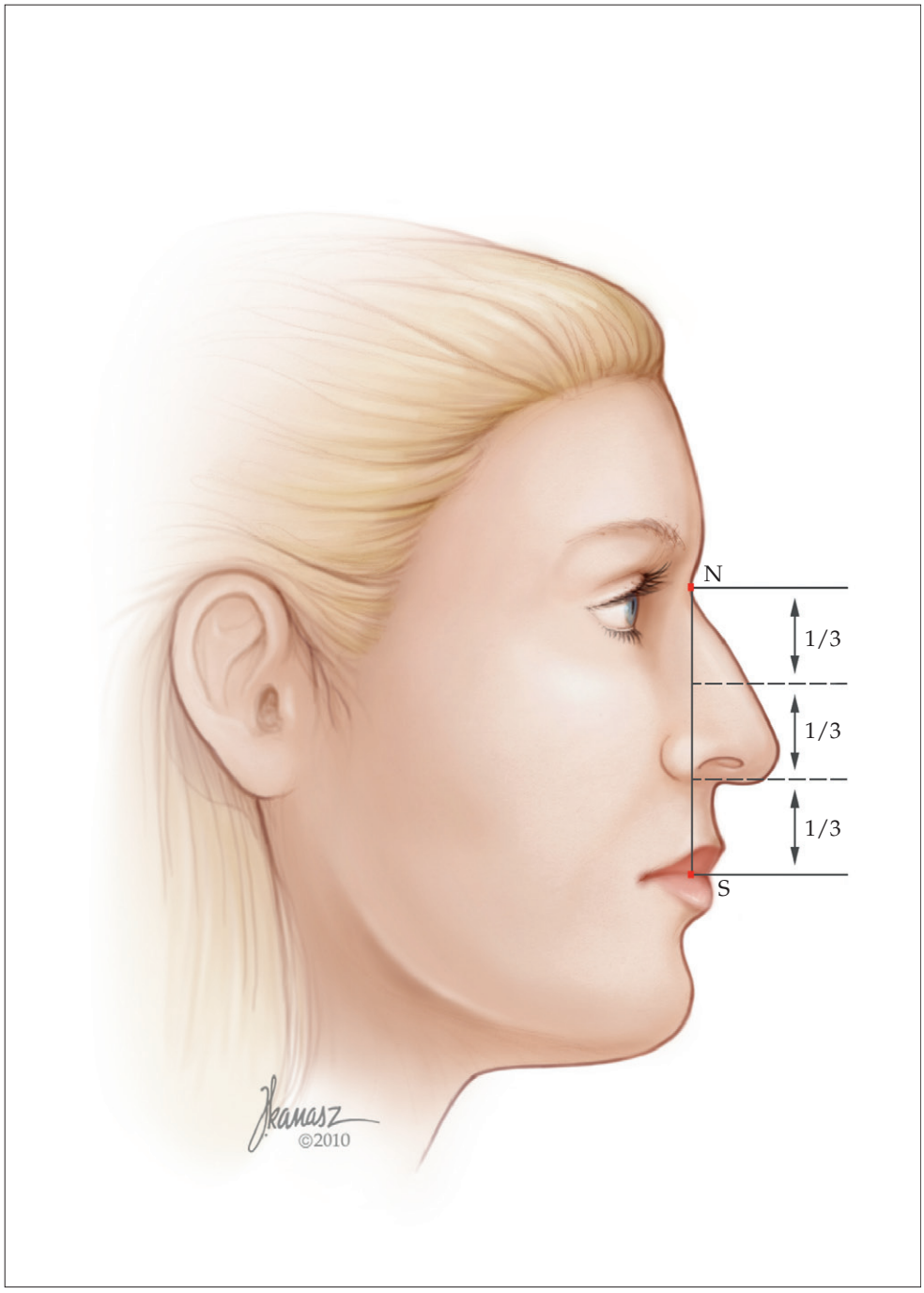


Figure 12.2 Analysis of vertical alar base disharmony on the profile view. Point N (nasion) is connected to point S (stomion) and the distance is divided equally into three. The caudal border of the alar base is located 2 mm caudal to the junction of the middle and lower thirds.

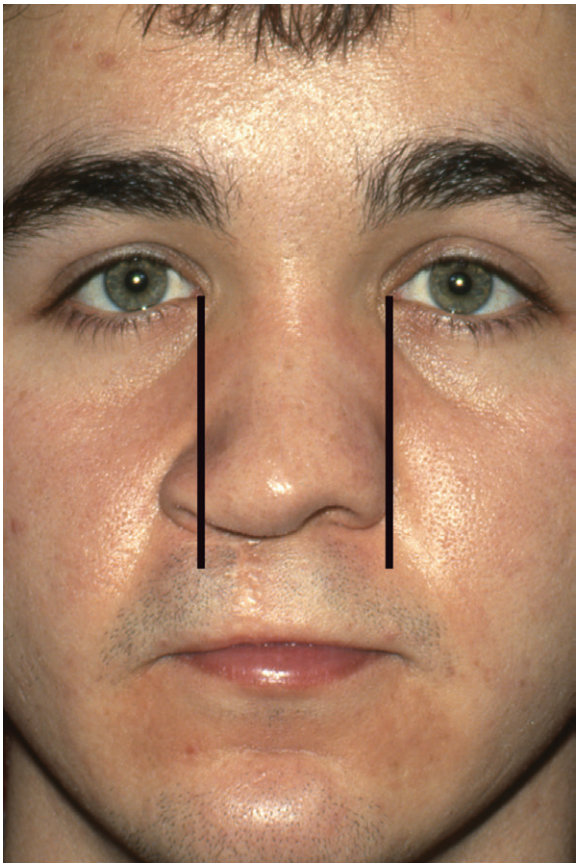


Figure 12.3 A patient with cleft lip deformity exhibiting significant horizontal excess width of the alar base on the cleft side.

Figure 12.4 A patient with a deficient alar base.

can be used as a guide to decide the width of the alar base. For analysis of this zone, as was discussed in Chapter 3, a vertical line dropped from the medial canthus in a nose with an optimal alar base should pass 1 mm medial to the outer boundary on each side of the alar base, as long as the intercanthal distance is normal.

The vertical alar base position is readily determined on the profile view (Figure 12.2). Point N (nasion) is connected to point S (stomion) and the distance is divided equally into three. The caudal border of the alar base is located 2 mm caudal to the junction of the middle and lower thirds.

Alar base deformities can include horizontal excess (Figure 12.3), horizontal deficiency (Figure 12.4), or vertical malposition, which is either caudal

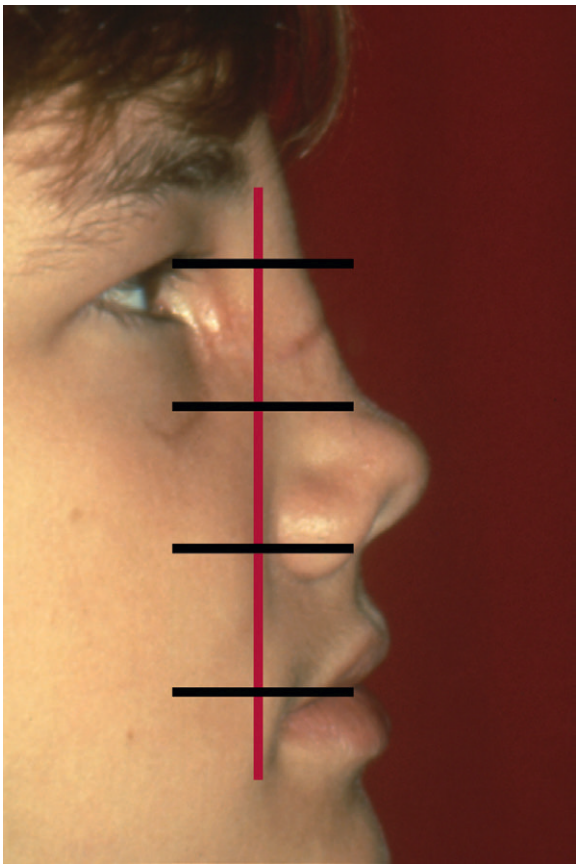


Figure 12.5 A patient with a caudally displaced alar base.

Figure 12.6 A patient with a cephalically malpositioned right alar base.

(Figure 12.5) or cephalad (Figure 12.6). Horizontal excess can be the result of a wide alar base, a thick alar base, or a wide nostril sill. A combination of these imperfections may also exist. An alar base deficiency is often more aesthetically displeasing and may be post-traumatic, post-infection, iatrogenic, post-ablative surgery, or congenital in origin. Some horizontal abnormalities are secondary to tip projection or maxillary abnormalities such as protrusion or retrusion. Correction of those underlying skeletal anomalies will improve the appearance of the alar base without the need for direct surgery on the base itself.

Cephalic malposition of the alar base gives the appearance of a longer nose and results in a more protruding columella. A caudally malpositioned alar base causes hooding of the base, a decrease in columellar show, and the nose often appears short. Either condition may be unilateral or bilateral.

Operative Techniques

The procedure can be conducted under general anesthesia in conjunction with more extensive rhinoplasty techniques. An isolated alar base surgery could be performed under local anesthesia with or without intravenous sedation.

Horizontal Deformities

Wide Nostril Sill

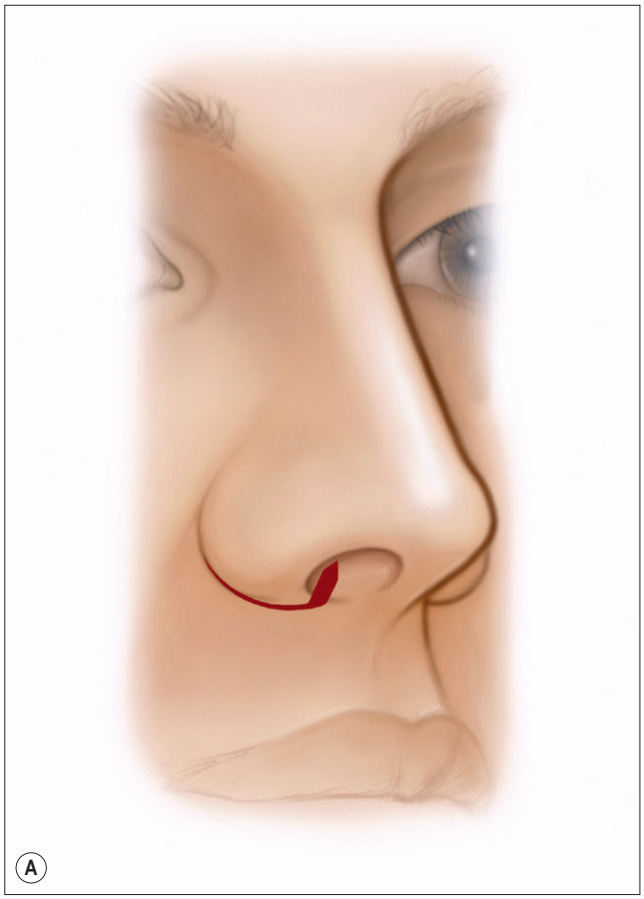
Careful analysis of the alar base may reveal a wider than optimal nostril sill. This is the second most common type of alar base abnormality. The excess nostril sill to be excised is marked by two almost parallel lines and connected by a horizontal line placed at the junction of the nostril sill and the upper lip and extended laterally along the alar–facial crease sufficiently to avoid formation of a dog-ear (Figure 12.7A; Animation 12.1). An incision is made using a no. 15 blade and the excess nostril sill is excised. An adequate amount of tissue is left on the lateral flap to assure a natural transition from the alar base to the nostril sill and to avoid any angulation between the sill and the ala. The dissection is continued with a microneedle electrocautery to release the alar nasalis muscle and to facilitate medial transposition of the alar base. The incision is then repaired with utmost precision using 6-0 plain catgut while maintaining the pleasing transition from the ala to the nostril sill (Figure 12.7B, C). Whenever there is a question about the strength of the repair, use of one 6-0 poliglecaprone suture to approximate the dermis and the subdermal layers is advisable.

Animation 12.1 •

Excess Nostril Sill and Wide Alar Base

This is the most common presentation of the wide nostril. The excised area includes a combination of the nostril sill and lateral alar base in varying proportions, depending on the degree of excess (Figure 12.8A, B). The technique is similar to the excision of a wide nostril sill except that the shape of the excised area is elliptical. Furthermore, the excised area could be more lateral, depending on the nostril shape. The posterior portion of the incision will be placed in the alar/facial crease, which often results in inconspicuous scars (Figure 12.8C; Animation 12.2; see Video 4.25 in Chapter 4).

Animation 12.2 •



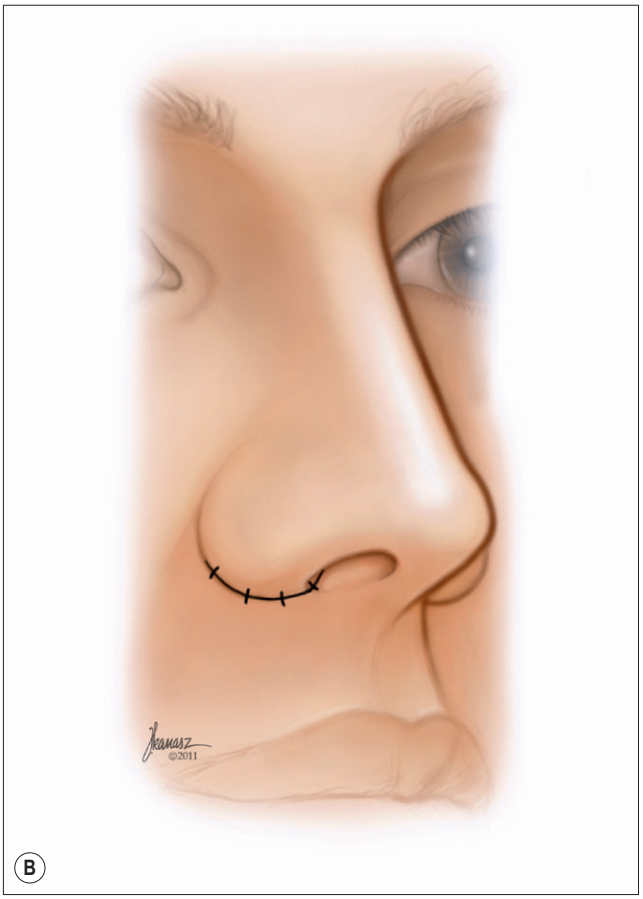


Figure 12.7 (A) Illustration demonstrating that the excess nostril sill to be excised is marked by two lines almost parallel to each other and connected with a horizontal line placed at the junction of the nostril sill and the upper lip and extended sufficiently laterally along the alar–facial crease to avoid formation of a dog-ear. (B) Repair of the incision. (C) Intraoperative basilar view of a sill excision marked to be excised on the patient's right and already excised and repaired on the left.

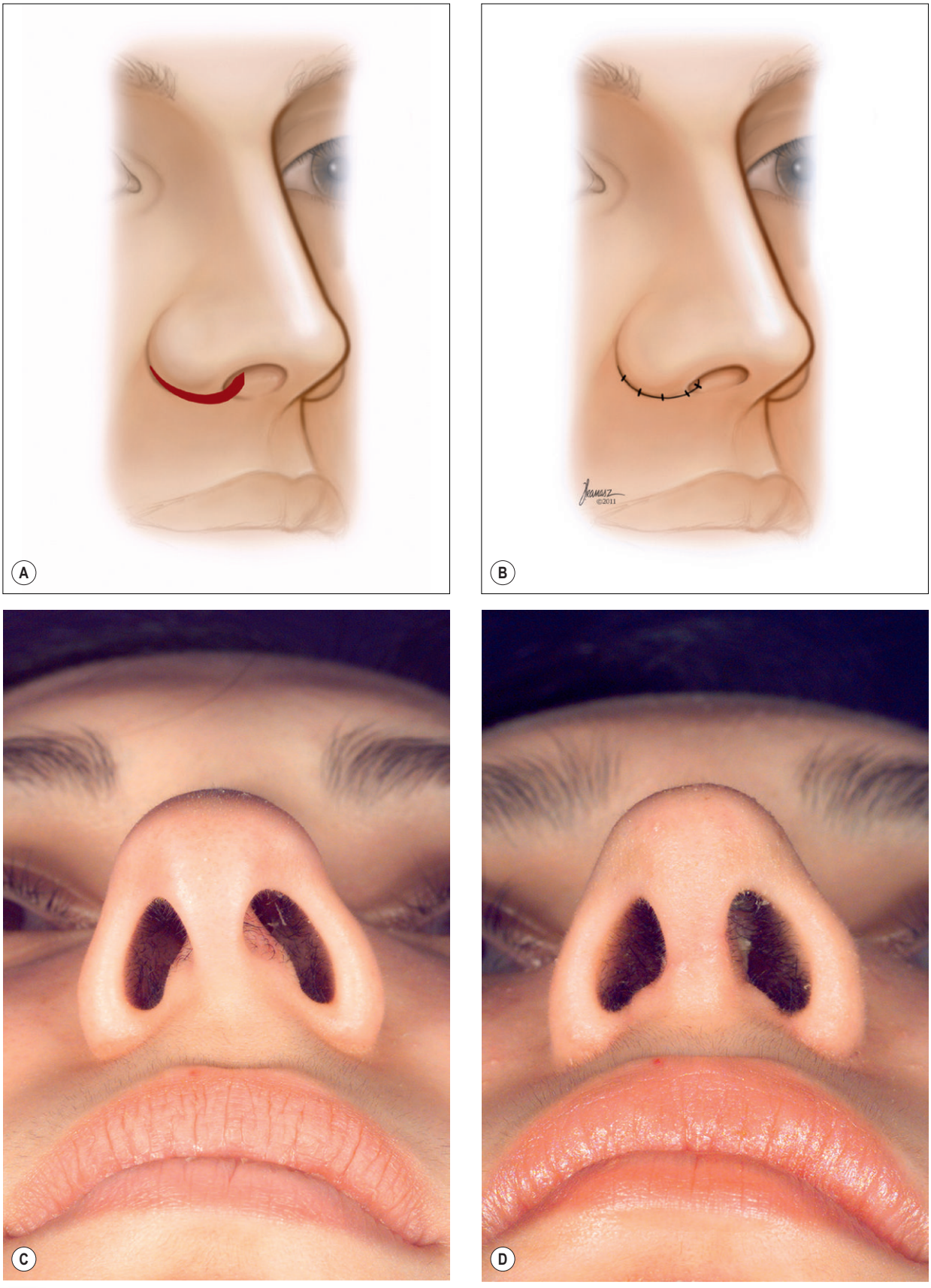


Figure 12.8 (A, B) Illustration of marking and excision of the combined sill and lateral alar base excess. (C, D) Basilar view before (C) and after (D) a combined alar base excision.

Excess Lateral Alar Base

This type of alar base abnormality is very rare and causes extra fullness laterally in the alar base when the patient smiles. The alar excision will be limited to the lateral portion of the ala and the vestibular lining will not be excised. Here too it is important to keep the incision in the alar–facial crease to minimize scar visibility (Figure 12.9; Box 12.1; Animations 12.3, 12.4).

Animation 12.3 • 12.4

Thick Alar Base

A crescent- or L-shaped (patient's left base) and a reverse-L (patient's right base) excision are designed in which the anteroposterior limb of the excision reduces the thickness of the alar base and the mediolateral portion of the excision narrows the nostril, if necessary (Figure 12.10). A mirror image incision is made on the right nostril.

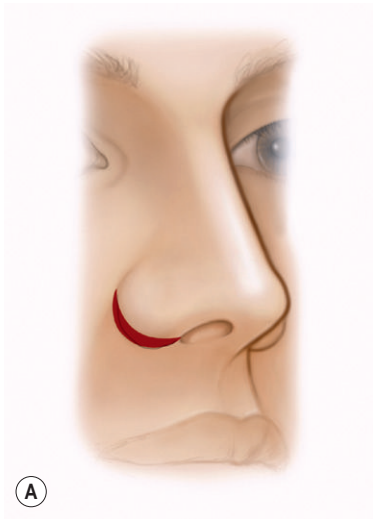
Combination of Wide Nostril and Thick Alar Base

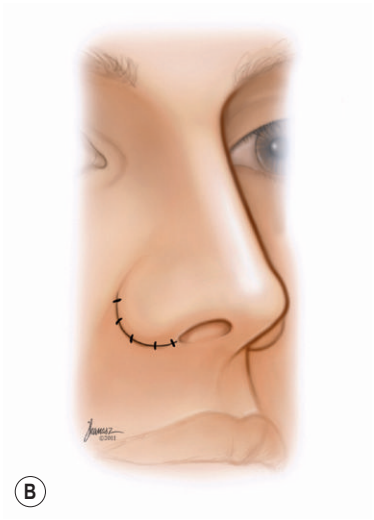
To simultaneously narrow the nostril and thin the alar base, an inverted T resection is used (Figure 12.11). An elliptical incision is made in the alar–facial crease and continued around the base of the nostril. A posteriorly based triangular incision is designed along the alar thickness to join the elliptical incision. The excess tissue is removed and the margins are reapproximated using 6-0 fast-absorbable plain catgut.

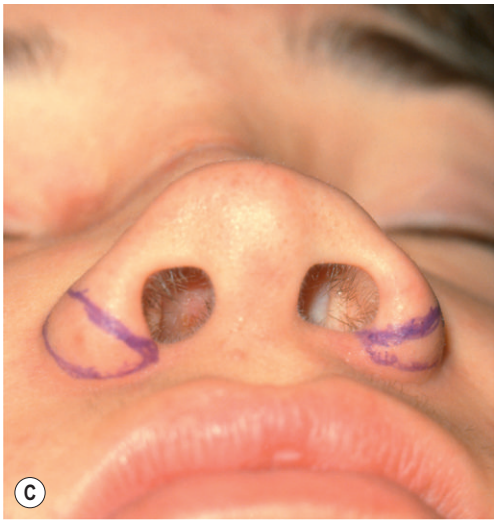
BOX 12.1

Surgical Steps: Figure 12.10

- An open technique was used
- The cephalic portion of the lower lateral cartilages were removed
- The dorsal hump was removed
- Bilateral low-to-low osteotomies were performed
- Bilateral medial and percutaneous vertical osteotomies were conducted
- Bilateral lateral osteotomies were performed
- The medial crura were approximated
- Transdomal sutures were used
- A simple interdomal suture was used
- A lateral crura spanning suture was used
- A supratip stitch was used to eliminate the dead space cephalad to the tip
- The alar bases were narrowed using a lateral excision technique







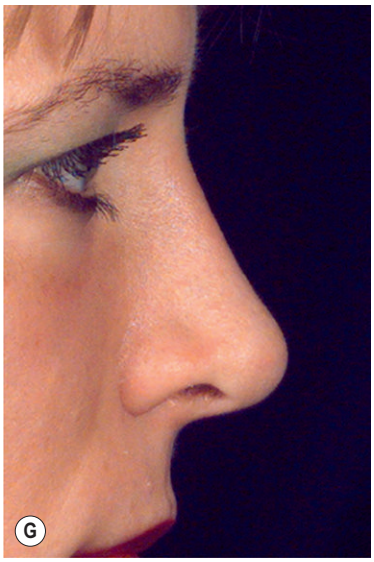
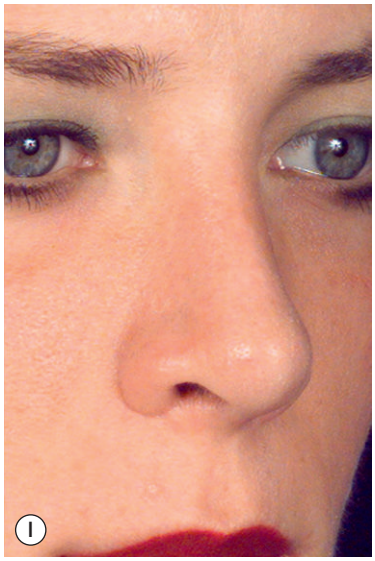
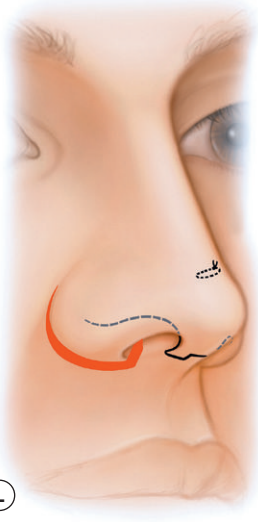


Figure 12.9 (A, B) Illustration of the design of the lateral excision and repair. (C) Intraoperative design of the lateral excision in a patient in whom the excess is only lateral. The standard views of a patient with a wide lateral alar base before (D, F, H, J) and 41 months after lateral alar base excision (E, G, I, K). Graphic illustration of the soft tissue surgical techniques (L) and alteration of the frame (M).





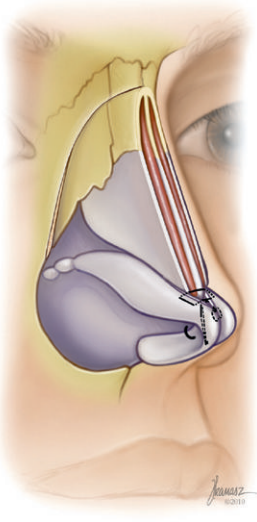


Figure 12.9, cont'd.

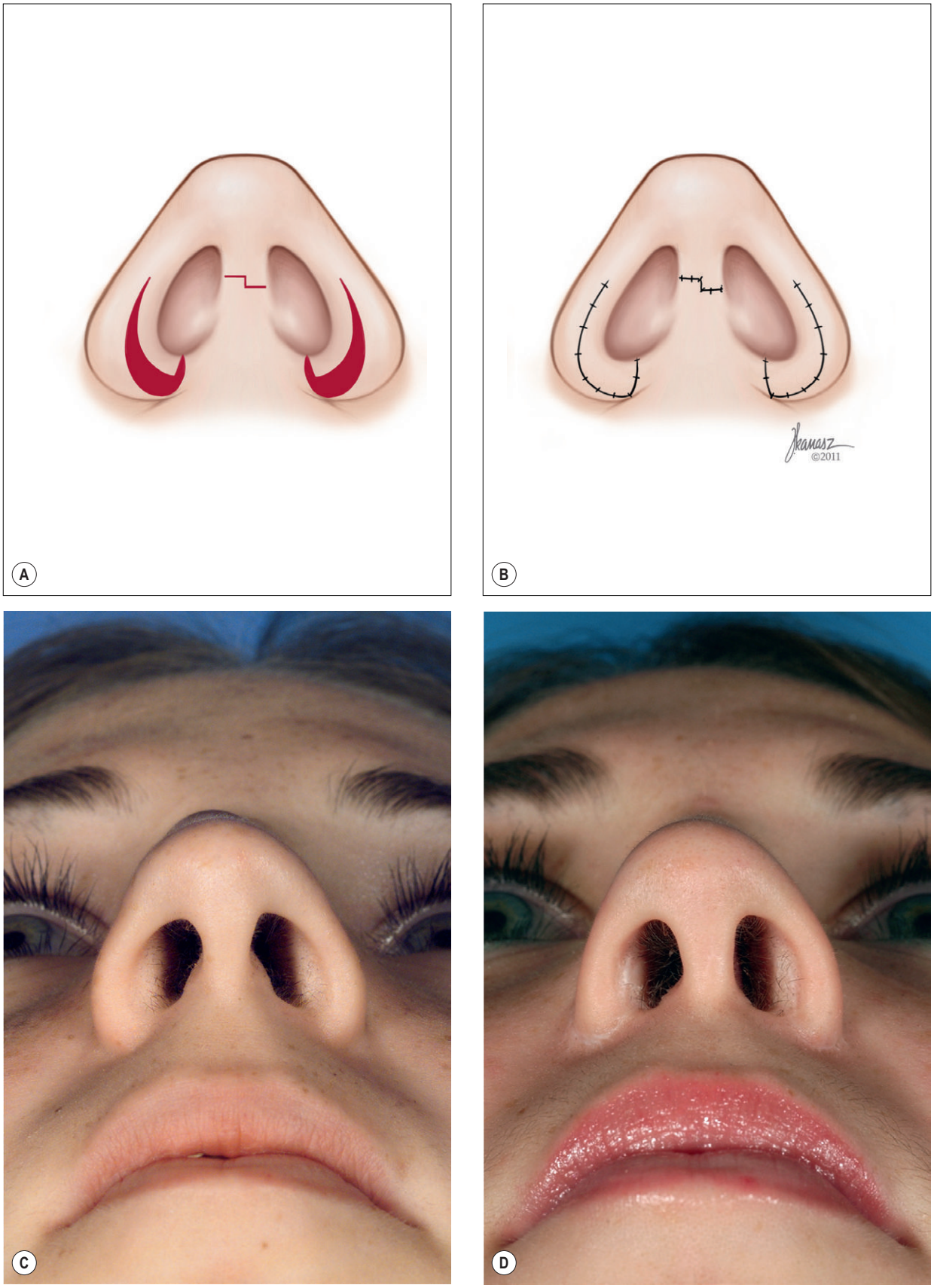


Figure 12.10 (A, B) Illustration of an L-shaped or crescent-shaped excision in which the anteroposterior limb of the L reduces the lateromedial thickness and the lateromedial excision narrows the nostril. (C, D) Basilar view of a patient before and after an L-shaped alar excision.

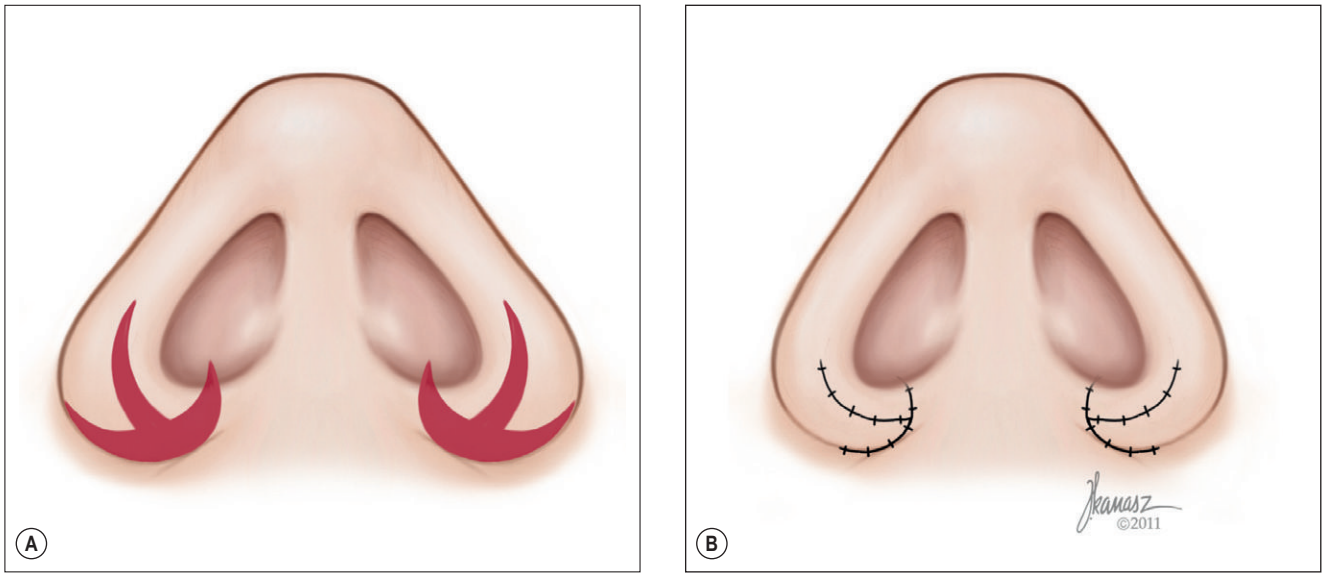


Figure 12.11 Illustration of an inverted T resection that is used to simultaneously narrow the nostril and make the alar base thinner.

Secondarily Widened Alar Base

When the alar base is widened as a result of maxillary advancement (Figure 12.12) or the tip is set back (Figure 12.13), it is important to use a nostril sill excision, a lateral excision, or a combination technique to harmonize the nasal base. Use of a cinch suture across the alar base may negate the need for an excision. This suture, however, may change lip shape and dynamics to some degree and should be used very cautiously.

Narrow Nostrils

Long, narrow nostrils are encountered occasionally and are secondary to either maxillary retrusion or excess nasal tip projection. Reduction of the nasal tip projection usually reverses this condition. If the problem is maxillary retrusion, a maxillary advancement will correct the alar base abnormality. Iatrogenically narrowed nostrils can be corrected by an alar rim graft, if the narrowing is mild, or by transposition of a subcutaneous-based skin flap from the lateral portion of the alar base to the medial portion of the alar base, as described by Constantian.[4]

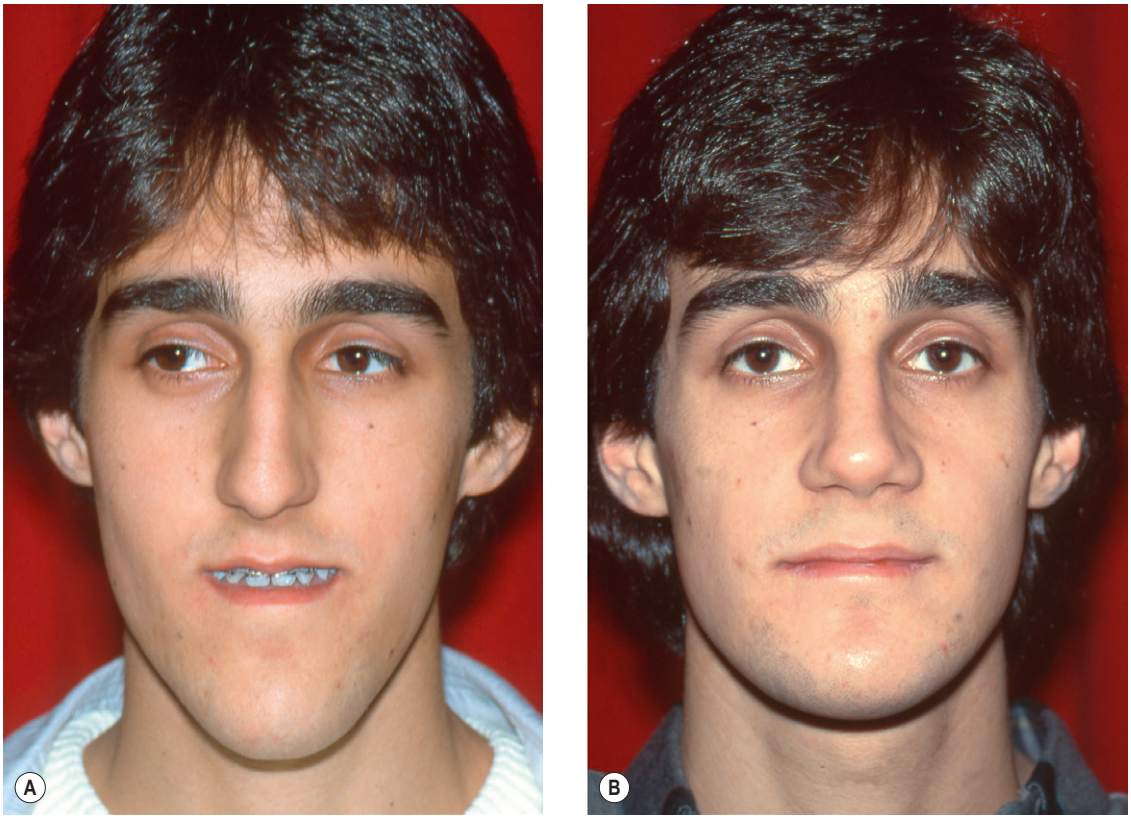


Figure 12.12 Front view of a patient before (A) and after (B) maxillary advancement causing significant widening.

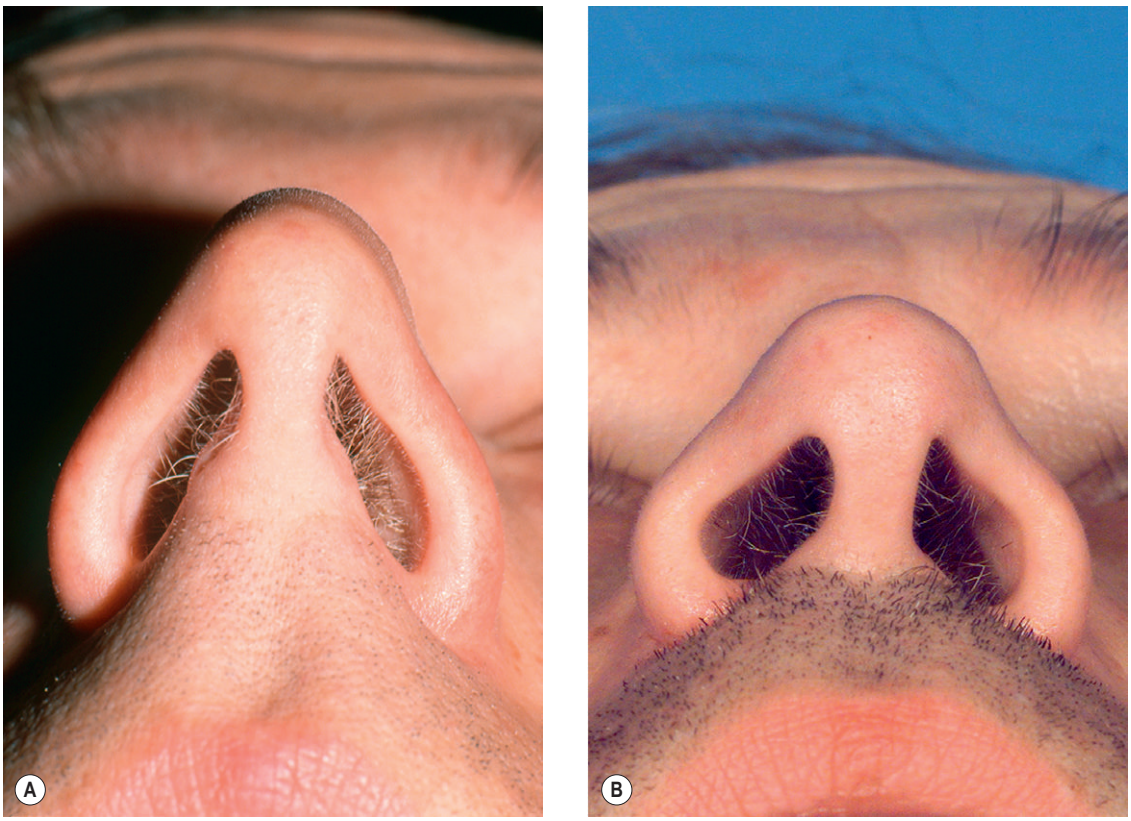


Figure 12.13 Basilar view of a patient before (A) and after (B) lowering tip projection, demonstrating significant widening of the alar base.

Vertical Alar Malposition

Cephalically Malpositioned Alar Base

If the alar base is wide in addition to being cephalically malpositioned, narrowing the alar base results in medial and caudal relocation of the base. Otherwise, the alar base can be repositioned caudally as a flap. An elliptical excision is designed at the junction of the alar base and the upper lip (Figure 12.14A). This incision is started at the alar–facial crease (Figure 12.14B) and continued around the base to the nostril sill. The size of the portion of resected skin is determined by the measurement of the distance from the alar base to the vermillion on the optimal side, which is transferred to the opposite side. The skin is excised. It is essential to completely release the alar nasalis muscle and undermine the ala adequately so that the alar base can be advanced caudally without any tension (Figure 12.14C). Otherwise, the procedure may result in elevation of the upper lip rather than caudal transposition of the alar base. If necessary, the incision should be extended further cephalad along the alar–facial crease. The repair is carried out using 6-0 fast absorbable catgut (Figures 12.14D–F).

Alar Base Dynamics

Alteration of the caudal nose projection produces the most significant dynamic changes in the alar base. When an overprojection is reduced (Figure 12.14), the extra soft tissue will extend caudally and laterally, necessitating a maneuver to narrow the alar base. Conversely, a wide alar base will be automatically corrected with an increase in the caudal nasal projection. Maxillary advancement widens the alar base while retraction of the maxilla narrows it. Lengthening the maxilla transposes the alar base caudally. Intrusion of the maxilla will result in cephalic displacement and will widen the alar base.

As the alar base is narrowed, the alar rim is repositioned caudally, which reduces the columellar show on the profile view. In most patients, this improves the nasal aesthetics. However, this will be detrimental to the nasal balance in patients with a caudally positioned alar rim (hanging ala) or a retracted columella.

Prior to any alar base resection, the columellar base and the footplates should be adjusted, if necessary. Excess footplate divergence may ostensibly make the nostrils look narrow, and repositioning the footplates may unveil sufficiency or even excess of the alar base. If placement of an alar rim graft is intended, it should be inserted before alteration of the alar base since it can widen the nostril to some degree.

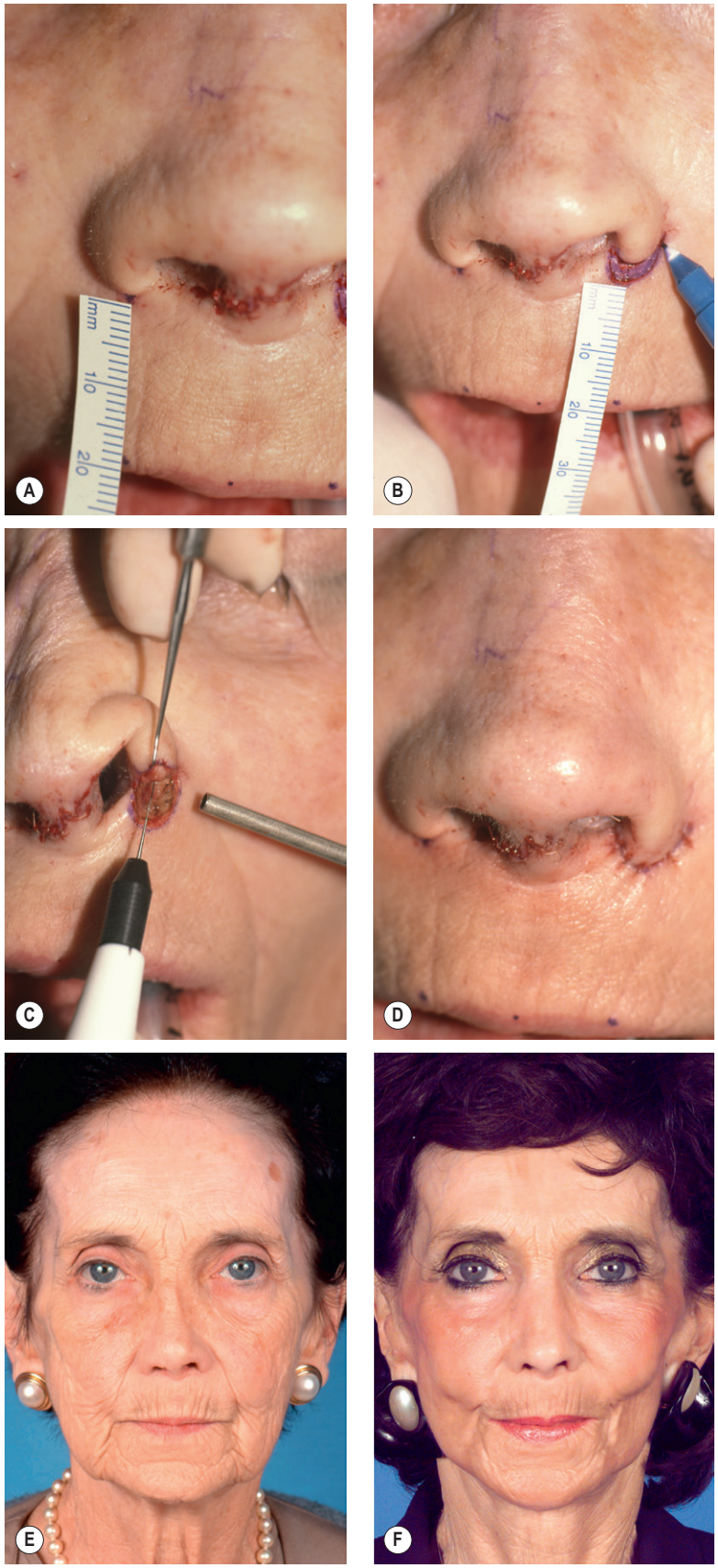


Figure 12.14 (A) The distance from the vermillion border to the alar base is measured on the side with optimal alar position. (B) The position of the alar base is mirrored on the side with a cephalically positioned alar base. (C) An elliptical excision is designed and the muscles are released to permit a tension-free repair. (D) The repair is completed using 6-0 fast absorbable catgut. Front view of a patient before (E) and after (F) repositioning of the left alar base.

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CHAPTER 13

Controlling the Nostril Size

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Pearls

- The anatomical structures that contribute to the balance of the nasal base include the nostrils, the alar rim, soft triangle, medial crura and footplates.
- The components of a short nostril include a short columella, redundant soft triangle lining, and weak and short ala.
- On the basilar view, the ideal ratio of the infratip lobule length to the nostril length is 40:60.
- In a patient who has an optimal infratip lobule volume with a short columella and inadequate tip projection, augmentation of the tip projection by way of an onlay tip graft, a shield graft, or use of transdomal sutures will increase the infratip lobule volume and create additional imbalance between the nostril and infratip lobule.

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- Means of elongation of the nostril length include insertion of a columella strut, approximation or reduction of the width of the footplates, application of an alar rim graft, elongation of the columella with suspension of the medial crura from the anterocaudal septum, and removal of a crescent-shaped piece of redundant soft triangle lining.
- Of the techniques available for the elongation of the nostril, removal of the soft triangle lining is the most potent one.
- Interdomal and transdomal sutures add to the lobule volume and also orient the nostrils more medially rendering them more vertical.
- Insertion of a columella strut will elongate the nostrils by stretching the soft tissues in the anterior direction, resulting in a medial orientation of the nostrils by virtue of placement of medial crura sutures to fix the columella strut, which is beneficial in most incidences.
- As the alar rim graft is inserted, not only does it correct the concavity of the ala, it also elongates the nostril.
- Patients who have large, deep facets and excessive infratip lobule volume would benefit from removal of the redundant soft triangle lining, which will elongate the nostril.

A congruous relationship between the nostril and the infratip lobule is crucial to nasal base harmony. Correction of the nostril size to bring it into equilibrium with the infratip lobule poses an additional challenge during the complex rhinoplasty procedure.[1] The anatomical structures that contribute to the balance of the base of the nose include the nostrils, alar rim, soft triangle, medial crura, and footplates. These are easily assessed on the basilar view, although any disharmony in this area will be reflected on the front and profile views as well. A short or long nostril, or deficient or excessive infratip lobule, exists when the ratio between the infratip lobule and nostril, which is normally 40:60, is disturbed. A relationship of 45:55 is also acceptable (Figure 13.1).[2] A short nostril is generally the consequence of abnormalities in several areas. The components that contribute to short nostril include a short columella, redundant soft triangle lining, and weak and short ala.[3] Alteration of any of these structures will contribute to elongation of the nostril proportionately.

Conversely, the nostril can be too long, due to a long columella. A patient can have optimal tip projection with insufficient infratip volume, which by necessity accompanies a long nostril.

Additionally, the relationship between the infratip lobule and the nostril can be adversely affected by an improper choice of techniques. In a patient who has an optimal infratip lobule volume with a short columella and inadequate tip projection, augmentation of the tip projection by way of an onlay tip graft, a shield graft, or use of transdomal sutures will increase the infratip volume and create additional imbalance between the nostril and the infratip lobule. In this circumstance, insertion of a columella strut, or a medial crura anchor

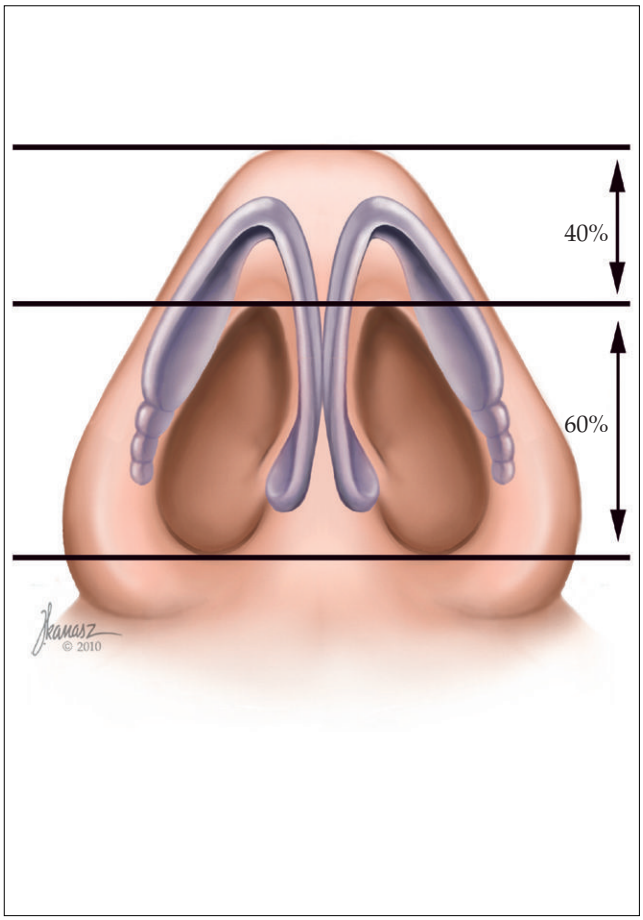


Figure 13.1 The nostrils take up about 60% of the distance from the tip to the posterior limits of the nostrils.

suture to elongate the columella, will provide the best outcome. However, if the infratip lobule volume is insufficient, causing inadequate tip projection, tip augmentation by the above means is a better choice. If the tip is underprojected and both the columella and infratip lobule are deficient, elongation of the columella and a tip graft will be the optimal choice.

Several maneuvers increase the length of the nostril. These include insertion of a columella strut, approximation or reduction of the width of the footplates, alar rim graft, elongation of the columella with suspension of the medial crura from the anterocaudal septum, and removal of a crescent-shaped piece of redundant soft triangle lining, the last being the most potent of all of these techniques. However, a patient who has a short nostril is commonly a candidate for a varying combination of these maneuvers. Some of the techniques that alter the orientation and length of the nostril have been discussed in other chapters and will not be elaborated on here. Other techniques are discussed below. The aim should be results that stand the test of time.

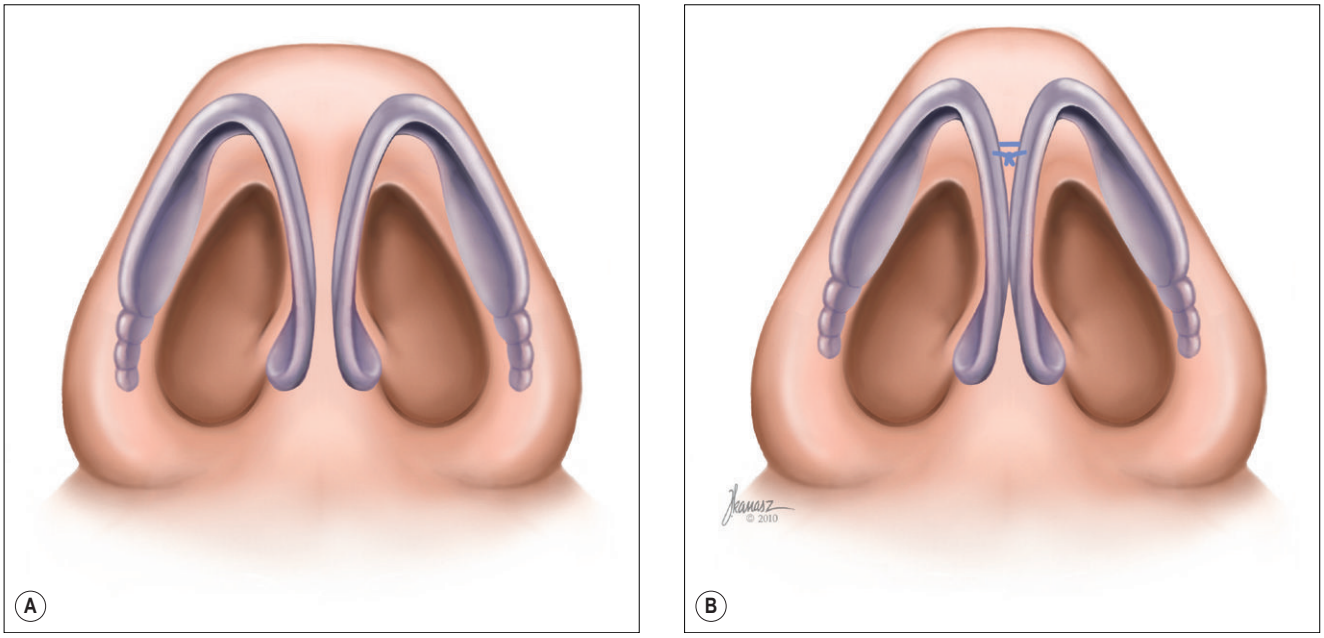


Figure 13.2 An illustration demonstrating that increase in lobule volume and change in the nostrils can be induced by the interdomal suture in a patient who has divergent domes.

Interdomal Sutures

Animation 13.1 •

Interdomal and transdomal sutures add to the lobule volume and also reorient the nostril direction, making the nostrils more vertical and more medially directed (Figures 13.2, 13.3; Animation 13.1).

Placement of a Columella Strut

Insertion of a columella strut will not only elongate the columella and nostril, it will also narrow the nostril and the alar base, since the soft tissues will be stretched anteriorly (Figure 13.4). Additionally, placement of sutures to fix the strut to the medial crura will narrow the distance between the medial crura and the domes, which will change the orientation of the nostrils.

Placement of Alar Rim Graft

Animation 13.2 •

As the alar rim graft is inserted, not only does it correct the concavity of the ala, it also elongates the nostril (Figures 13.5, 13.6; Animation 13.2; see Video 4.25a in Chapter 4).

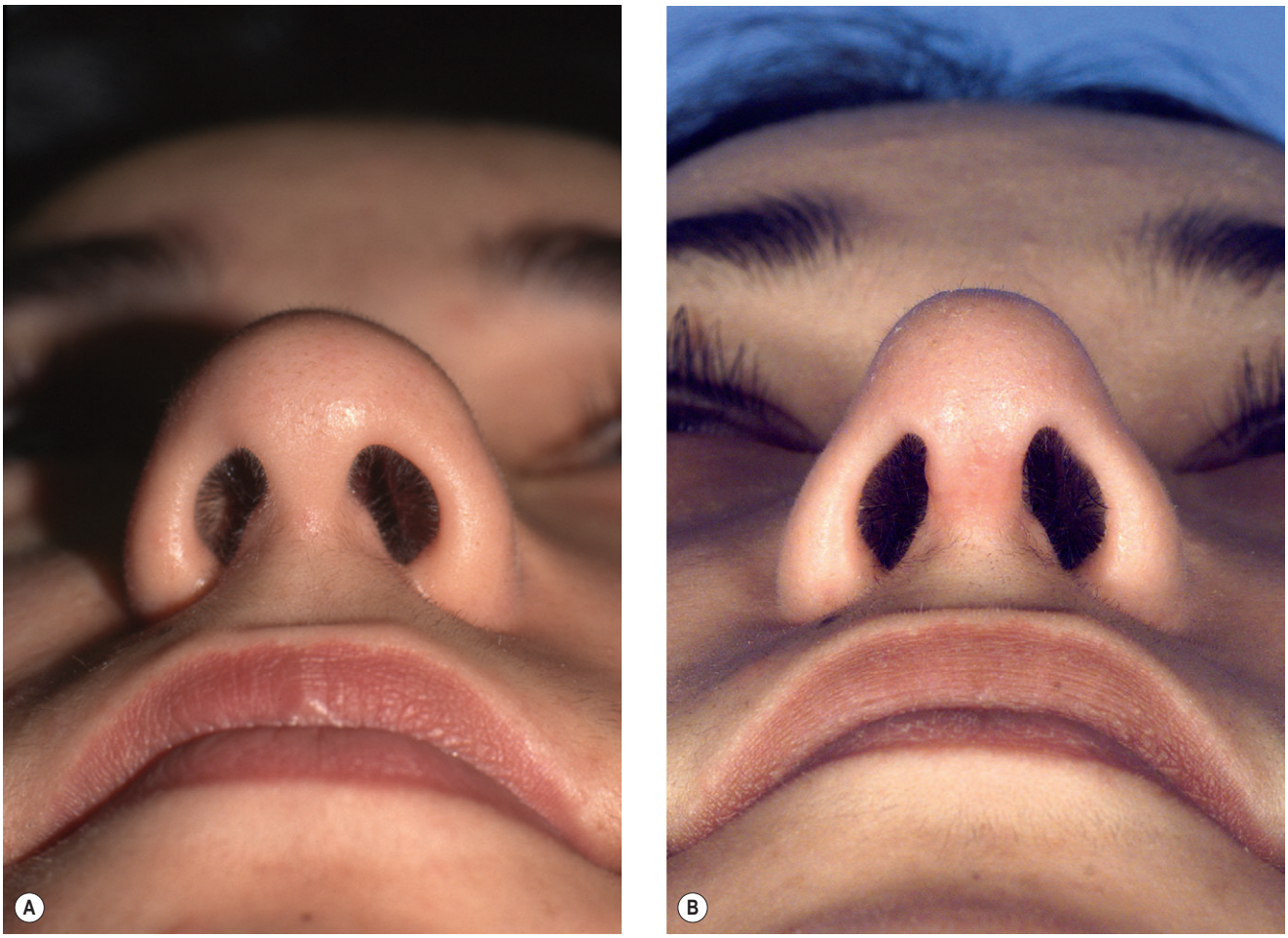


Figure 13.3 Basilar view before (A) and after (B) placement of an interdomal suture resulting in an increase in infratip lobule volume.

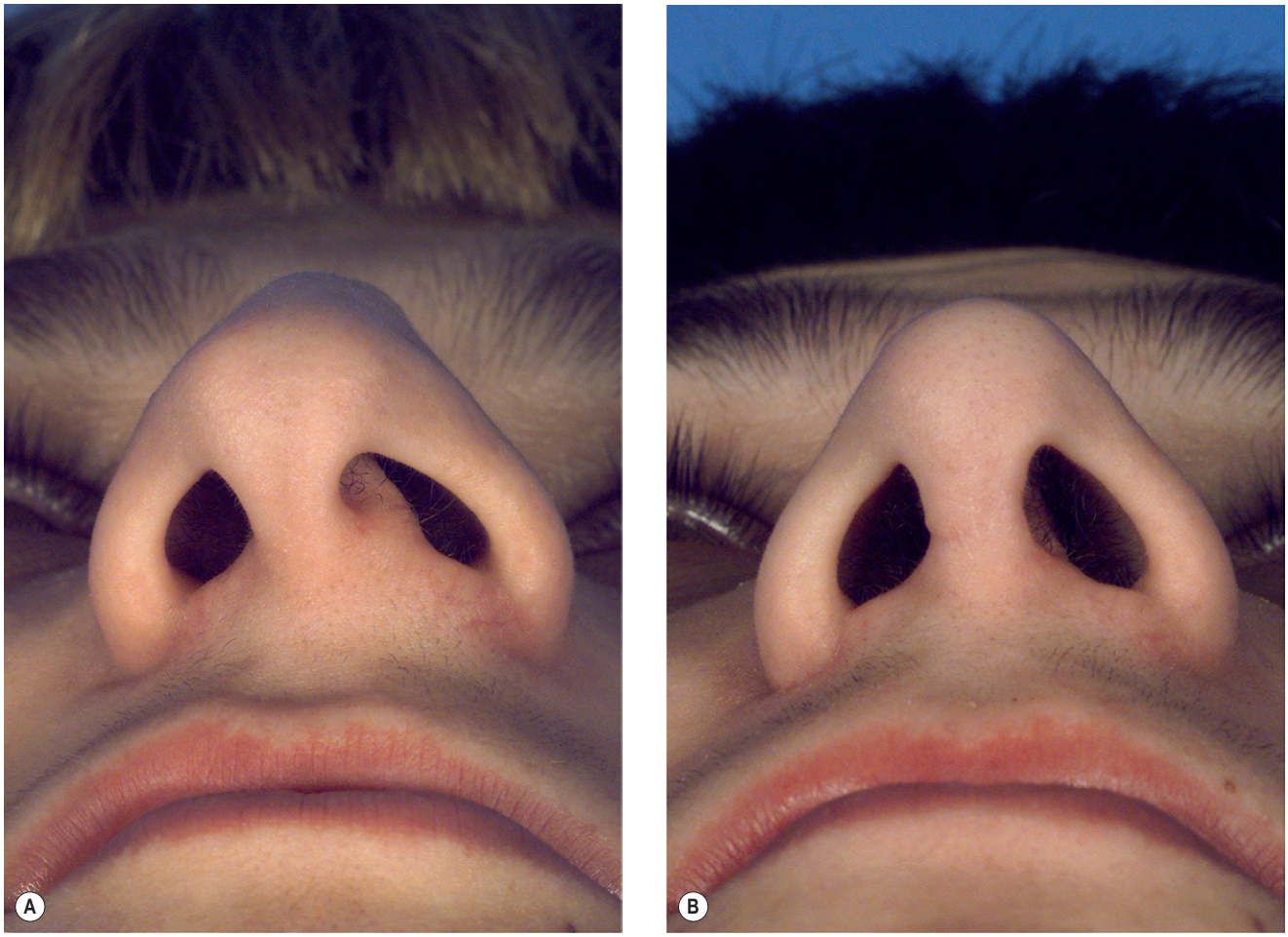


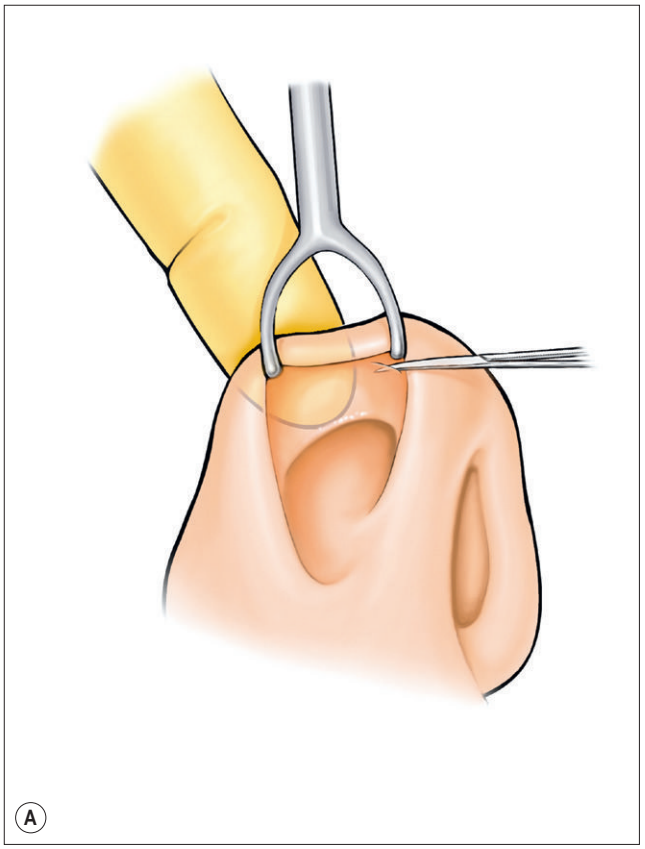
Figure 13.4 Basilar view demonstrating elongation of the nostril and better balance between the infratip lobule and the nostrils resulting from placement of a columella strut.

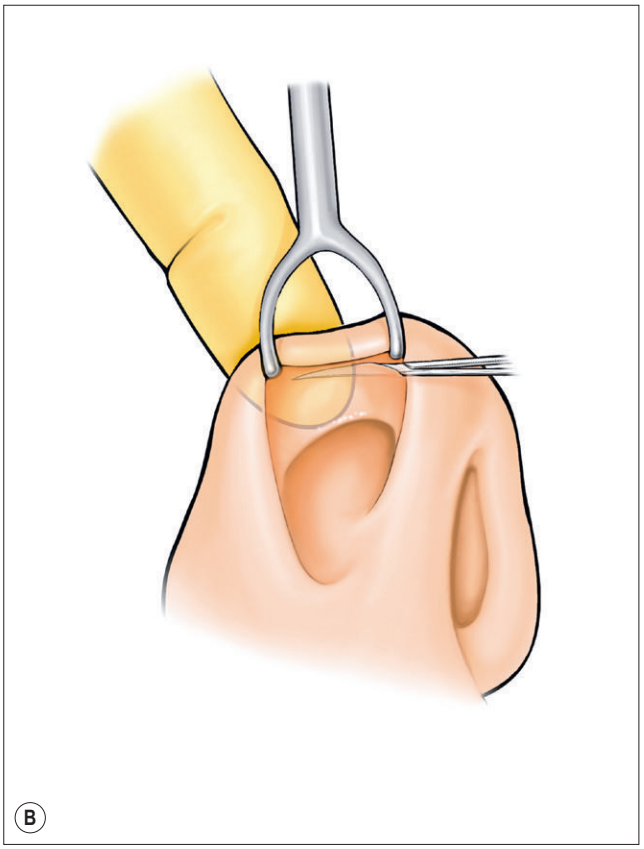
Soft Triangle

Patients who have redundant soft triangle tissues have a greater distance between the anterior border of the nostrils and the posterior border of the domes. Commonly, these patients have large, deep facets and require excision of the redundant soft triangle lining to elongate the nostril (Figures 13.7, 13.8; Video 13.1).

Video 13.1 •

Many patients require a combination of techniques (Figure 13.9).





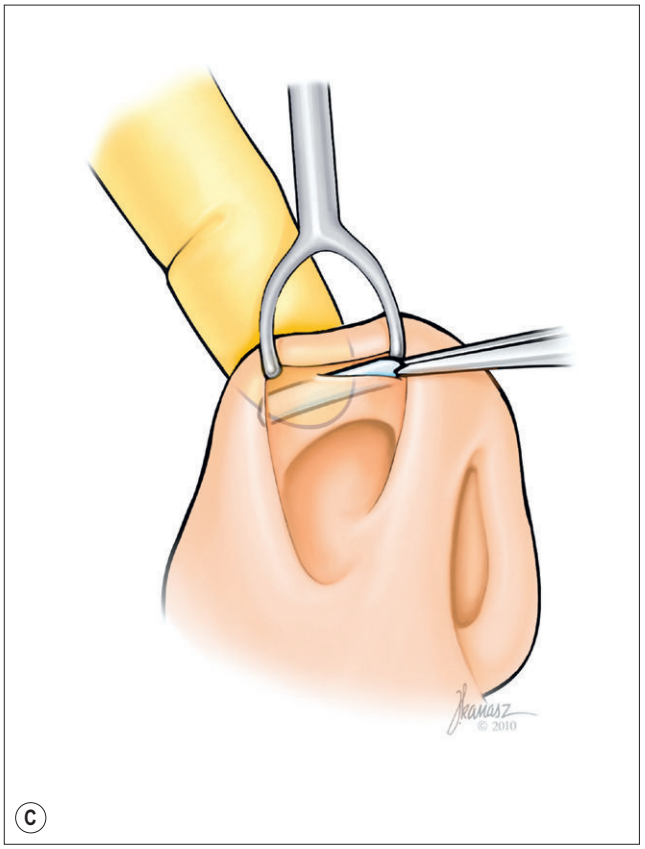


Figure 13.5 (A) An incision is made along the alar rim anteriorly and a pair of iris scissors is used to create a pocket along the rim. (B) A pocket is dissected parallel to the rim caudally. (C) A piece of cartilage 13–15 mm long and 3 mm wide is inserted in the pocket.

Figure 13.6 Basilar view demonstrating that insertion of an alar rim graft and support of the alar rim will result in elongation of the nostril.

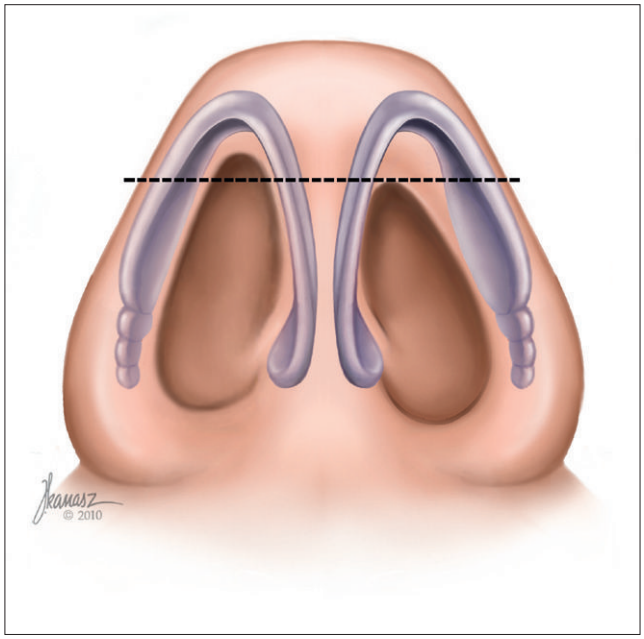


Figure 13.7 Illustration of discrepancy between the left and the right nostril caused by excessive soft triangle lining.

Figure 13.8 Basilar view before (A) and after (B) reduction of the soft triangle lining and approximation of the medial crura for elongation of the nostrils to restore a better basilar balance.

Figure 13.9 Basilar view of a nose with significant distortion of the nostrils due to Binder syndrome before (A) and after (B) placement of a columella strut, elongation of the columella, narrowing of the tip, removal of soft triangle lining, and placement of an alar rim graft.

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Video 13.1 A crescent-shaped piece of the redundant soft triangle lining is excised to elongate the nostril.

14 CHAPTER

Rhinoplasty and Time Element

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Pearls

- The nose should appear close to optimal a year after surgery as the major soft tissue swelling subsides and should retain the desired shape for the rest of the patient's life.
- The results of rhinoplasty continuously evolve due to the effects of gravity and aging.
- A common example of a flaw that may not easily be detected during the surgery but may become discernible over a period of years is an inverted V deformity related to a medial shift of the upper lateral cartilage.
- Violation of the nasal muscles could result in some irregularities on animation months or years later that are not noticeable during the immediate postoperative period.

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- The firmer the structure under the skin, the more likely it is that the overlying soft tissues will become thinner with time.
- It is crucial to bevel the graft margins to avoid a harsh appearance of the frame over a long term follow up.
- On patients with thinner skin, use of conchal cartilage as an onlay graft with preserved perichondrium draped over it or a gently bruised septal cartilage graft is superior to intact septal or costal cartilage graft.
- One common post-rhinoplasty occurrence is tip rotation caudally. This can be prevented with a tip rotation suture using a permanent material such as 5-0 clear nylon.
- Patients who smoke experience a loss of skin elasticity and thickness more quickly in the cephalic half of the nose, while they have a greater propensity to develop supratip deformity due to hyperactive sebaceous glands and thickening of the soft tissues with time.
- Sun exposure also accelerates aging and reduces skin elasticity, resulting in the loss of soft tissue volume, thus revealing minor imperfections over a period of years.

Although we all advocate not making any judgment about rhinoplasty results until at least 1 year after surgery, this time frame has been arbitrarily assigned and there is no scientific evidence that nose remodeling ceases after 1 year. In fact, it is my firm conviction that the results of rhinoplasty evolve continuously. This is true of the face and body, since gravity and aging alter soft tissue thickness and reduce the effectiveness of concealment of residual flaws by the soft tissues. However, one can argue that most changes occur during the first postoperative year. The results surgery is aiming for should stand the test of the time, which means that the nose should appear close to optimal a year later as the major soft tissue swelling subsides, and should retain the desired shape for the rest of the patient's life. There are three elements that interact with the nose over time: soft tissue thickness, nose frame quality, and environmental factors. We will discuss each separately.

Soft Tissue Thickness

As discussed in Chapter 1, the soft tissues of the nose encompass the skin, the subcutaneous layers, including the superficial musculoaponeurotic system and muscles, and the periosteum. The thickness of the skin is variable, depending on gender and age. As we age, the thickness of the skin undoubtedly diminishes. Therefore, over decades, nose frame imperfections that were veiled with a blanket of soft tissues may become discernible. It is therefore crucial to observe the remodeled frame as thoroughly as possible using an open technique to eliminate minor flaws that may not be easily detected by palpation of the skin after the injection of vasoconstrictive materials and owing to swelling during the surgery. A common example of such a flaw is medial shift of the upper lateral cartilages, which may not be readily detected

intraoperatively. Many inverted V deformities become evident over a period of 6 months to a year and sometimes several years after the surgery, depending on the thickness of the soft tissue. The reality is that swollen tissues during the early stages and scar tissue later may hide this defect, only for it to become noticeable when the swelling subsides and the scar tissue remodels. To prevent this displeasing outcome, the frame of the nose needs to be arranged in such a way that, whether the skin is thick or thin, the dorsal lines will remain congruent. Often, by compressing the skin and temporarily relieving the soft tissue edema during surgery, one can, to some degree, detect an inverted V deformity that may not be obvious. This small maneuver can establish the need for spreader grafts and obviate a revision surgery. Thinning of the soft tissues as a result of aging is detrimental in a large majority of patients (Figures 14.1–14.3; Animations 14.1, 14.2, 14.3; Boxes 14.1–14.3). However, patients with thick skin often benefit from time effects, and better definition, especially in the tip and supratip area, is observed as time elapses (Figure 14.4; Box 14.4; Animation 14.4). It may take several years before this type of favorable change is visible.

Animation 14.1 • 14.2 • 14.3 • 14.4

Violation of muscles of the nose could be another factor resulting in some irregularities in animation months or years after surgery that are not noticed during the immediate postoperative period. Additionally, as mentioned previously, if an attempt is not made to start the initial dissection in the subperiosteal and subperichondrial planes, every time the dorsal hump is removed, the periosteum is also removed with it. With repeated surgeries, this results in the loss of a significant amount of soft tissue. The thinning becomes more noticeable with time and will reveal the underlying imperfections in the nasal frame. The thinning of the nasal soft tissues is inauspicious, especially in the dorsal region, where imperfections can be uncovered, and it is usually accompanied by telangiectasis.

Nose Frame Quality

The firmer the structures under the skin, the more likely it is that the overlying soft tissues will become thinner with time. This is beneficial to some patients and detrimental to others. In patients with thick skin, creation of a firm, properly projected nasal frame results in better nose definition over a period of several years. Conversely, this type of frame under thin skin will reveal the stark cartilages after an adequate follow up period and the nose may appear unnatural. It is therefore essential to create a slightly softer frame for a patient with thinner skin and a firmer frame for a patient with thicker skin, in order to achieve an enduring optimal outcome. However, in either circumstance, the margins of the cartilage grafts should be beveled and blended to minimize visibility notwithstanding what happens to the soft tissues. On patients with thinner skin, use of conchal cartilage as an onlay graft with preserved perichondrium on top of it, or a gently bruised septal cartilage graft is superior to intact septal or costal cartilage graft.

Figure 14.1 A patient before (A–D), 4 months after (E–G) and 16 years after rhinoplasty (H–K), demonstrating development of midvault weakness and a hint of inverted V deformity and caudal rotation of the tip that was not present shortly after surgery. Please note how much the tip has narrowed over the years. Illustrations demonstrate the soft tissue maneuvers (L) and frame alterations (M) performed during surgery.

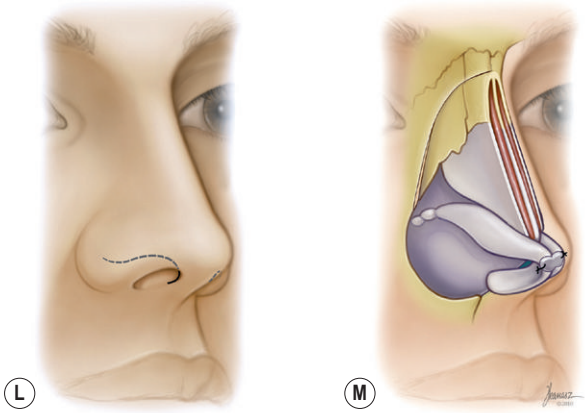

Figure 14.1, cont'd.

BOX 14.1

Surgical Steps: Figure 14.1

- A closed technique was used
- The cephalic portion of both lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was done through an open technique
- A low-to-low osteotomy was done bilaterally
- An onlay tip graft was applied
- The anterior caudal septum was resected as a wedge with a proportional amount of membranous septum

Figure 14.2 Development of a dorsal depression 12 years after surgery (I–L) that was not present 4 years after surgery (E–H). The patient's preoperative photos are shown in A-D. Illustrations demonstrate the soft tissue maneuvers (M) and frame alterations (N) performed during surgery.

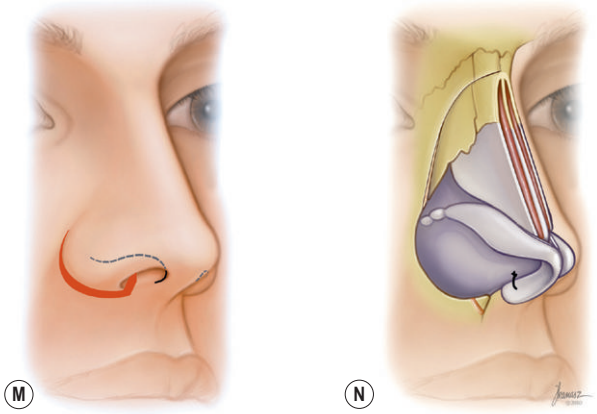

Figure 14.2, cont'd.

BOX 14.2

Surgical Steps: Figure 14.2

- A closed technique was used
- Rim incisions were made
- The cephalic portion of both lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was done through an open technique
- A bilateral conservative inferior turbinectomy was done
- A low-to-low osteotomy was done bilaterally
- A nasal spine osteotomy was made and the nasal spine was repositioned in the midline
- Footplates were approximated
- The alar bases were narrowed with combined excision bilaterally

Figure 14.3 Development of midvault narrowing and tip derotation 18 years after surgery (I–L) compared to 6 months postoperatively (E–H). The patient's preoperative photos are shown in A-D. Illustrations demonstrate the soft tissue maneuvers (M) and frame alterations (N) performed during surgery.

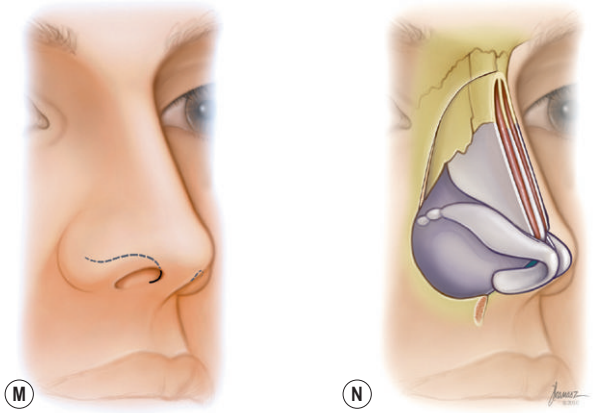

Figure 14.3, cont'd.

BOX 14.3

Surgical Steps: Figure 14.3

- A closed technique was used
- The cephalic portion of both lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was done through an open technique
- A low to low osteotomy was done bilaterally
- The anterior caudal septum was resected as a wedge with a proportional amount of membranous septum
- The nasal spine was reduced

Figure 14.4 Careful evaluation of this patient's photographs 14 months (E–H) and about 10 years postoperatively (I–L) reveals that the supratip deformity and excess width of the tip has improved over the years and that she has developed a supratip break and the tip has become narrower as time has elapsed. The patient's preoperative photos are shown in A-D. Illustrations demonstrate the soft tissue maneuvers (M) and frame alterations (N) performed during surgery.

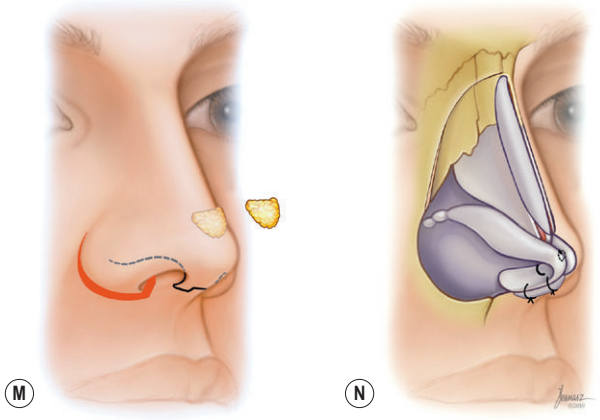

Figure 14.4, cont'd.

BOX 14.4

Surgical Steps: Figure 14.4

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- A septoplasty was done through an open technique
- A bilateral conservative inferior turbinectomy was done
- A low-to-low osteotomy was done bilaterally
- The medial crura were approximated
- A figure-of-eight interdomal suture was used
- A dorsal graft was applied
- Supratip soft tissue was removed
- The alar bases were narrowed with combined excision bilaterally
- A columella onlay graft was applied

One common occurrence with patients who have not undergone tip rotation with fixation using permanent suture material is rotation of the tip caudally as time elapses. With or without surgery, the fibrous bands between the lower and upper lateral cartilages, and between the septum and the lower lateral cartilages, lose their strength and the nose becomes elongated. Therefore, it is essential to fix the cephalically rotated tip to the septum with nonabsorbable sutures to prevent it from yielding to gravity forces and subsequently rotating caudally.

Environmental Factors

Patients who smoke experience a loss of skin elasticity and thickness more quickly in the cephalic half of the nose, while they have more propensity to develop supratip deformity with time. Sun exposure also accelerates aging and reduces skin elasticity, resulting in the loss of soft tissue volume and, therefore, reveals minor imperfections over a period of years. It is, again, crucial to create a frame that is as flawless as possible to produce a lastingly successful outcome in this group of patients.

CHAPTER 15

Correcting the Nasal Deformity Resulting from Cocaine Insufflation

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Pearls

- Caustic effects of insufflated cocaine can destroy layers of the septum and the nasal wall.
- The number one criterion for successful correction of cocaine nose deformity is evidence of a patient's commitment to abandon cocaine use. This should be confirmed by an independent, qualified specialist.
- The former cocaine user has to have been clean for at least 3 years before surgery is considered.
- The common features of the cocaine nose include foreshortening, an inverted V deformity, deviation at various levels of the nose commonly towards the nostril that is used for insufflation, collapse of the dorsum with saddle nose deformity, retraction of the columella, a pseudohump, widening of the nose, deviation of the columella to the affected side, and notched and retracted ala with concavity.

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- Internal examination of the nose commonly demonstrates complete or incomplete destruction of the cartilaginous septum.
- Presence of active rhinitis contraindicates any surgical intervention and may raise suspicion of continued use of cocaine.
- If the alar rim is retracted more than 2 mm, the initial open rhinoplasty incision should include a V-Y advancement incision of the vestibular lining.
- While dissecting the dorsum, every effort should be made to avoid any tears in the dorsal lining that may join the nasal cavity with the dorsal space. Any inadvertent tears should be repaired and made watertight immediately.
- If K wires are used to fix the cartilage to the underlying nasal bone, it is important to avoid penetration of the nasal lining with the end of the K wire, which otherwise can seed bacteria within the cartilage at the time of retrieval of the wire.

In 1912, Owens first reported on the effects of cocaine on the nasal mucosa.[1] Recreational use of cocaine has been rising in the USA and the nose is the most common route for ingestion.[2] The intense vasoconstriction of the nasal mucosa resulting from insufflation of cocaine causes an array of caustic effects with varying degrees of damage to the nasal lining.[3] The additive nature of the insult may ultimately result in complete necrosis of all layers of the septum and nasal wall. As the necrosis deepens, an infection may superimpose and cause additional loss of soft tissues and cartilage. With further use of cocaine, the perforation expands and often results in collapse of the dorsum, retraction of the ala, and foreshortening of the nose.[4]

Some propose the use of microvascular techniques for repair of the perforated septum.[5,6] However, in the author's view, this type of heroic measure, which may in fact constrict the airway due to the bulk of the flap, may not be necessary in most patients.

Patient Assessment

Prudent care of the patient with this deformity begins with an in-depth evaluation of the patient's frame of mind. The number one criterion for successful correction of a cocaine nose deformity is evidence of the patient's commitment to abandon cocaine use, which should be confirmed by an independent qualified specialist. Otherwise, the gratifying result that is attained can easily be destroyed by insufflation of additional cocaine. This lifestyle change should have lasted for at least 3 years before surgery is considered.

The magnitude of the nose deformity should not distract the examiner and result in focusing on the nose only. It is still crucial to pay attention to the entire face rather than concentrating only on the nose. The surrounding structures and even the distant facial features should be assessed, as in

primary and secondary rhinoplasty patients, prior to focusing on the nose. One important adjacent structure to examine is the maxilla.

The magnitude of the nasal deformity varies from patient to patient. There could be a small perforation in the septum with no reflection on the external appearance of the nose. However, those who seek the assistance of a plastic surgeon often demonstrate extensive nasal deformity. The common features of cocaine nose include foreshortening, an inverted V deformity and deviation at various levels of the nose structures. The deviation is largely related to the substantial destruction and necrosis within the insufflation tract. For a right-handed person, this is usually the right side of the nose. Because of the loss of alar support, the nasal tip is pulled to the affected side. Collapse of the dorsum results in a saddle-nose deformity and foreshortening with over-rotation of the tip. Loss of the septum may result in retraction of the columella. In this scenario, the entire nose will become shorter, rather than the tip simply rotating cephalically. The dorsal collapse also results in a hump that was not there previously. This is often the consequence of a posterior shift of the dorsal soft tissues while the bony frame remains intact and protrudes anteriorly in relation to the rest of the dorsum. Additionally, the collapse of the dorsum results in a lateral distribution of the soft tissues and widening of the nose and the alar base. Nasal tip projection is commonly reduced because of the loss of the support ordinarily provided by the anterocaudal septum. The nose appears significantly distorted on the basilar view. The columella deviates to the affected side, which results in a misaligned tip structure. The ala becomes notched and concave on the affected side and often the alar base is malpositioned.

Internal examination of the nose commonly demonstrates complete or near-complete destruction of the cartilaginous septum and a varying degree of rhinitis. Presence of active rhinitis contraindicates any surgical intervention. Such patients should be treated vigorously with systemic antibiotics and topical mupirocin until the rhinitis subsides completely. The presence of rhinitis should also lead one to question whether the patient has indeed ceased using cocaine. The turbinates are commonly enlarged.

Surgical Technique

Since a variety of grafts will be required for this surgery, it is prudent to perform the surgery under general anesthesia. The nose is infiltrated with local anesthetic and vasoconstrictive solution as discussed in Chapter 4. Because of the significant scarring, infiltration of these solutions may prove difficult.

Although this deformity can also be corrected through a closed rhinoplasty, Far greater precision will be achieved with an external approach. A step or V incision is made in the columella and extended to the ala. If the alar notching is greater than 2 mm, it is advisable to plan a V–Y advancement, as described

in Chapter 11. Otherwise, if an incision is made in the rim and it then becomes advisable to do a V–Y advancement, it will be impossible. If the V–Y advancement is part of the surgical plan, the columella incision is extended towards the intercartilagenous area in a V shape and brought back towards the alar base on the affected side. On the contralateral side, the V–Y advancement is often not necessary, since there is not much retraction of the ala.

The incision is deepened and a skin flap is elevated. After the lower lateral cartilages are exposed, the dissection is continued towards the nasal bones. This is where care has to be practiced to maintain the integrity of the nasal roof lining and to keep the dorsal space isolated from the nasal cavity to reduce the risk of postoperative infection. The existing components must be separated from each other and the soft tissues elongated as far as possible, all the while maintaining the integrity of the nasal lining. A varying degree of difficulty can be encountered during the separation of the soft tissues. Any inadvertent tears in the lining should be repaired and made watertight. As the nasal bone area is reached, the dissection will continue in the subperiosteal plane. The importance of protecting the nasal lining cannot be overstressed. Each time the soft tissues are released, the basal unit (tip and columella) is repositioned caudally to check whether there is enough freedom in the soft tissues to allow for replacement of the missing frame pieces and elongation of the nose. Otherwise, the dissection is continued until the soft tissues are released sufficiently. If the dorsal lining becomes the limiting factor, one can dissect under the nasal bones and release the soft tissues cephalically to gain more length. This seldom becomes necessary, but if it does, it is important to eliminate any communication between the nasal cavity and the dorsum by suturing the nasal lining to the nasal bones after advancement using 5-0 poliglecaprone sutures. It may become necessary to make small burr holes in the nasal bones to pass the poliglecaprone suture to reattach the advanced nasal roof lining to the bone and create a watertight separation of the nasal cavity from the surgical site on the dorsum. If there is a dorsal hump, it is removed with a rasp and osteotomy of the nasal bone is only performed if necessary. The wound is irrigated copiously with saline solution containing 1 g of a first-generation cephalosporin in 1000 ml of the irrigation solution.

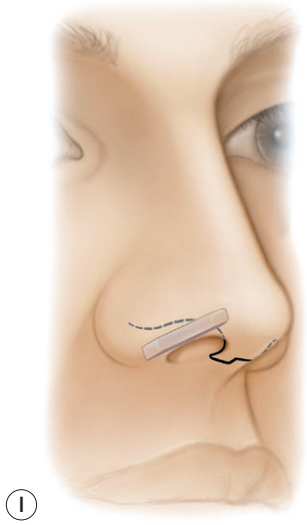
A costal cartilage is harvested next. This is discussed in detail in Chapter 19. If the nose skin is very thin, the perichondrium is harvested and applied as a soft tissue graft. If necessary, a piece of conchal cartilage graft is harvested as described previously for tip reconstruction. A dorsal graft is then carved, adhering to Gibson's principles. The tongue-and-groove technique is used to achieve an optimal length in patients who do not need significant dorsal augmentation, as described in Chapter 8. This technique can be used only if there is a residual dorsal septal bar. The dorsum is augmented with a costal cartilage graft wherever there is a deficit. The graft is prepared in a keel shape, tapered laterally, and should be narrower cephalically and caudally. The caudal and cephalic profiles are lower than the central portion of the dorsum. To reduce the potential for warping, a threaded Kirschner wire is passed longitudinally through the fabricated dorsal cartilage graft, as described by

Gunter.[7] This technique is not necessary on every patient. It is only used on grafts that seem to have a tendency to warp while on the operating room table. The domes are pulled anteriorly and a columella strut is placed in position and tattooed across using a 25 gauge needle to assist in proper alignment of the medial crura and columella strut while suturing the graft in position, as described in Chapter 4 (see Video 4.20biii). The columella strut is fixed to the medial crura in at least two places using 5-0 PDS sutures. The dorsal graft is placed in position and the caudal end is notched to accommodate the columella strut and fixed to it using 5-0 PDS or 5-0 nylon if there is no residual dorsal septal cartilage to utilize the tongue-and-groove technique. The columella strut should extend beyond the anterior limits of the dorsal graft to aid in the creation of an optimal supratip break. The dorsal graft is either sutured in position or fixed to the underlying bones using two temporary K wires. It is crucial to make sure that these K wires do not penetrate the nasal lining. The cartilage graft can also be fixed in position using a microscrew. The base of the columella strut is fixed to the anterior nasal spine using a 5-0 nylon or PDS suture. It is important to realize that it is not necessary to use both the tongue-and-groove technique and a dorsal conchal cartilage graft. If there is no need for the dorsal augmentation, and there is a residual dorsal bar of the septum, the tongue-and-groove technique is employed, as indicated above.

The alar cartilage is seldom completely destroyed. If the entire lateral crus is missing, it is replaced using a thin layer of costal cartilage harvested from the surface of the rib cartilage. Maxillary grafts are used if necessary to reconstruct the lateral and the premaxillary area. However, this is also rarely necessary. The position and direction of the dorsal graft is checked repeatedly to ensure proper alignment with the rest of the facial structures. If a tip graft is deemed necessary, it is preferably obtained from the conchal cartilage rather than the costal cartilage, since the latter is often too harsh for this purpose. The tip punch is used to harvest the graft and it is fixed in position using 6-0 polyglactin, as described in Chapter 7 and Chapter 19. The position of the graft is checked three-dimensionally to ensure optimal symmetry. If V–Y advancement is one of the surgical goals, the V flap that was raised initially on the affected ala is dissected completely to the rim and reflected caudally, like an open page of a book. The V–Y advancement is accomplished, the Y portion is repaired first and then the flap is advanced caudally. Prior to the closure of the flap, an alar rim graft is applied to ensure proper stability. Simple stents are applied to the medial and lateral surfaces of the ala and are fixed in position using a 5-0 polypropylene through-and-through stitch.[8] The columellar incision is then repaired using 6-0 fast absorbable catgut. An Aquaplast™ and a metal dorsal splint are applied if an osteotomy has been performed. Otherwise, SteriStrips would be sufficient. The external K wires are usually removed in 3 weeks.

While challenging, this surgery is the most gratifying type of rhinoplasty. If patients are selected properly and remain cocaine-free, this surgery can change their quality of life tremendously and erase the stigma of their previous poor judgment (Figures 15.1, 15.2; Animation 15.1; Animation 15.2; Boxes 15.1, 15.2).

Figure 15.1 A patient with typical features of cocaine nose before (A, C, E, G) and after (B, D, F, H) correction of the deformity and reconstruction of the maxillary defect with costal cartilage graft. Illustrations demonstrating soft tissue and alar rim graft positioning (I) and frame alterations (J).



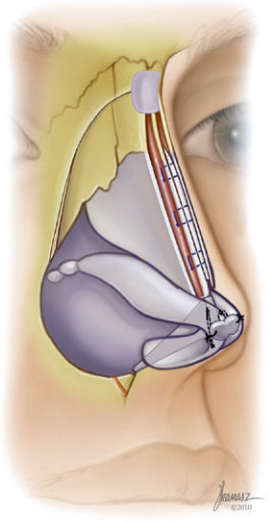


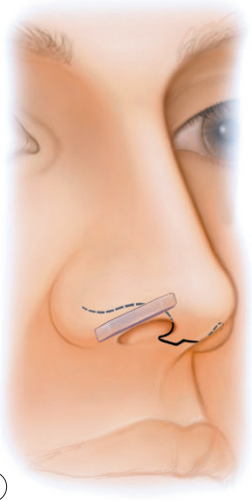
Figure 15.1, cont'd.

BOX 15.1

Surgical Steps: Figure 15.1

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A bilateral low-to-low osteotomy was performed
- A left-sided spreader graft was applied
- A columella strut was applied
- Transdomal sutures were placed
- A simple interdomal suture was used
- An onlay tip graft was applied
- The posterior caudal septum was resected as a wedge with a proportional amount of membranous septum
- Nasal spine osteotomy was performed and the nasal spine was repositioned in the midline
- The nasion was augmented
- An alar rim graft was applied on the right
- A septal rotation suture was used
- The depressor nasi septi muscle was removed
- The digastric septi nasi labialis muscle was removed
- V–Y advancement of the right alar lining was carried out to correct the retracted right ala
- Maxillary augmentation was carried out with cartilage graft

Figure 15.2 This patient initially had an optimal alignment of the nose postoperatively. However, she developed deviation to the right as a result of loss of the right alar graft. She underwent a second operation to improve the alignment of her nose with placement of the alar rim graft. Standard views demonstrate improvement in the nasal form 1 year after revision surgery (B, D, F, H). The patient's preoperative photos are shown in A, C, E, G. Illustrations demonstrating soft tissue (I) and frame alterations (J) to achieve the intended goals.



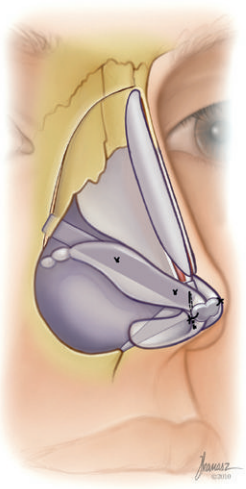


Figure 15.2, cont'd.

BOX 15.2

Surgical Steps: Figure 15.2

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- A bilateral low-to-low osteotomy was performed
- A columella strut was applied
- Transdomal sutures were placed
- An onlay tip graft was applied
- A dorsal graft was applied
- A lateral crura strut was applied
- An alar rim graft was applied on the left
- V–Y advancement of the right alar base was performed to correct the alar retraction

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CHAPTER 16

Rhinoplasty in Patients with Thick Skin

In this Chapter Online at **expertconsult.com**

Online Contents

Animations

Demonstration of the Surgical Steps on a Patient with Thick Skin Animation 16.1
Demonstration of the Surgical Steps on Another Patient with Thick Skin Animation 16.2

Pearls

- Patients who have excess skin thickness related to sebaceous hypertrophy would benefit from alteration in diet, use of Retin A, and on rare occasions, treatment with Isotretinoin.
- Patients who have excess skin thickness related to thick dermis will incur thinning of the skin over the years if the underlying frame is firm and stable.
- In a small percentage of patients, the amorphous tip configuration is related to the extra fat in between and overlying the domes. To correct this condition, the extra fat is removed, leaving the dermis and a small amount of subdermal fat intact.
- Another crucial step in achieving an optimal rhinoplasty outcome in patients with thick skin is elimination of any dead space.
- A supratip stitch is routinely used on such a patient in order to approximate the supratip skin to the underlying dorsal frame.

One of the anatomical variations that add to the complexity of rhinoplasty is excessive thickness of the nose skin, where achieving optimal tip definition becomes more taxing. Excess skin thickness can result from sebaceous overactivity or inherent thickness of the dermis. The latter represents more of a challenge. There is a difference in the quality of the skin between the patients in Figures 16.1 and 16.2. The patient in Figure 16.1 has large pores and

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Figure 16.1 A patient with sebaceous overactivity.

Figure 16.2 A patient with a thicker dermis.

significant sebaceous activity, which can, to a large degree, be controlled by a combination of diet, the use of Retin A and, if necessary, isotretinoin. In contrast, the skin of the patient in Figure 16.2 cannot be altered by these measures. Isotretinoin is not an innocuous drug and should be prescribed under the supervision of a dermatologist. It is detrimental to healing and may cause scar hypertrophy if surgery is performed while the patient is on this medication. It is, therefore, advisable to delay surgery until 6 months after cessation of isotretinoin treatment. Additionally, the use of laser or dermabrasion could be beneficial to patients with sebaceous hyperplasia. Here again, one has to avoid using lasers or dermabrasion for 1 year after treatment with isotretinoin. A better option is to proceed with laser treatment or dermabrasion prior to the use of isotretinoin.

A more difficult example of a patient with thick skin is illustrated in Figure 16.2. This patient has a thick dermis with fewer sebaceous glands. The skin is somewhat red and shiny. The solution in this group of patients is establishment of a firm underlying frame to create reasonable nose definition. The

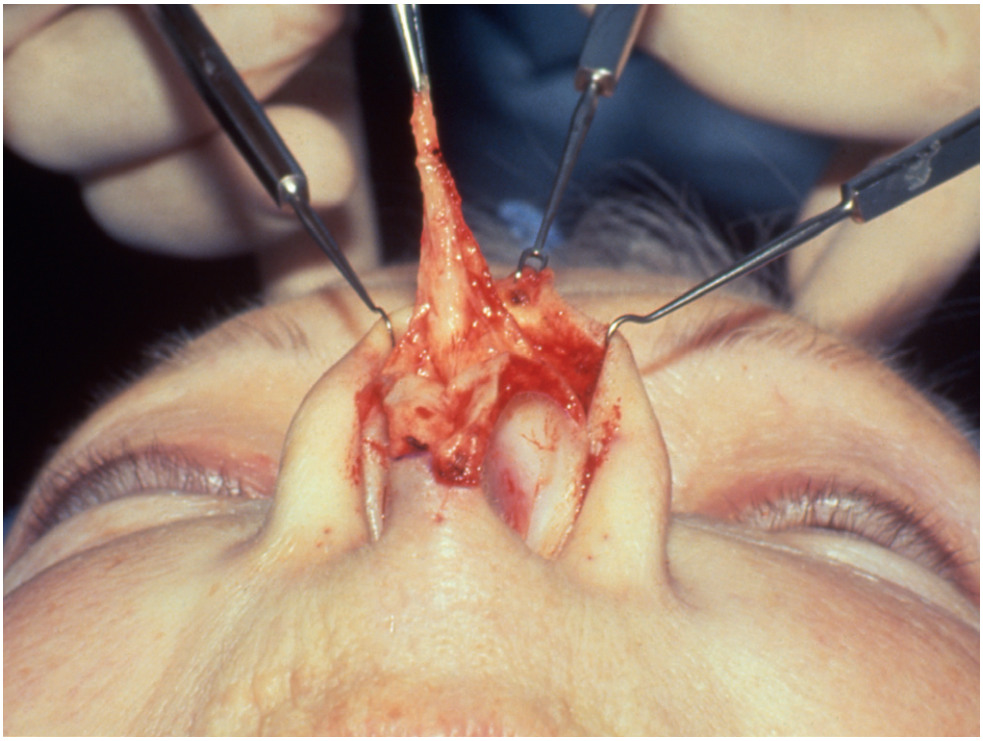


Figure 16.3 Using an open technique, a healthy skin flap is elevated and the fat between and overlying the domes is removed.

firmer the nose frame, the more likely it is that the skin will become thinner over a period of years and the definition will be close to optimal.

One factor that contributes to the amorphous tip is the presence of extra fat lying between the domes and perhaps overlying them. To correct this unfavorable anatomical presentation, excess fat is removed using an open technique. A columellar incision is made and a healthy nasal tip skin flap is elevated, leaving the excess subcutaneous fibrofatty tissues over the lower lateral cartilages and the part between the domes attached to the underlying frame. After the skin flap is adequately mobilized, the frame is denuded by removing excessive fibrofatty tissue (Figures 16.3, 16.4). It is crucial to ensure that the skin flap is not defatted, since this may not be safe. The flap will still contain the dermis and a small layer of subdermal fat. One must be cautious when performing this operation on current or previous heavy smokers.

The second step in obtaining a successful outcome in a patient who has thick nose skin is creation of a firm cartilaginous frame. Commonly, spreader grafts are placed, utilizing either a firm piece of cartilage from the septum or costal cartilage. The lateral crura are strengthened with a lateral crura strut.[1] A columella strut is inserted and the domes are approximated. When the tip is rotated cephalically, a 5-0 nylon suture is used to fix the medial crura to the caudal septum to avoid rotation of the tip due to the heavy weight of the skin, as described in Chapter 4. Any gap between the cartilaginous structures,

Figure 16.4 The fat removed from between and overlying the domes along with removed cephalic portion of the lower lateral cartilages.

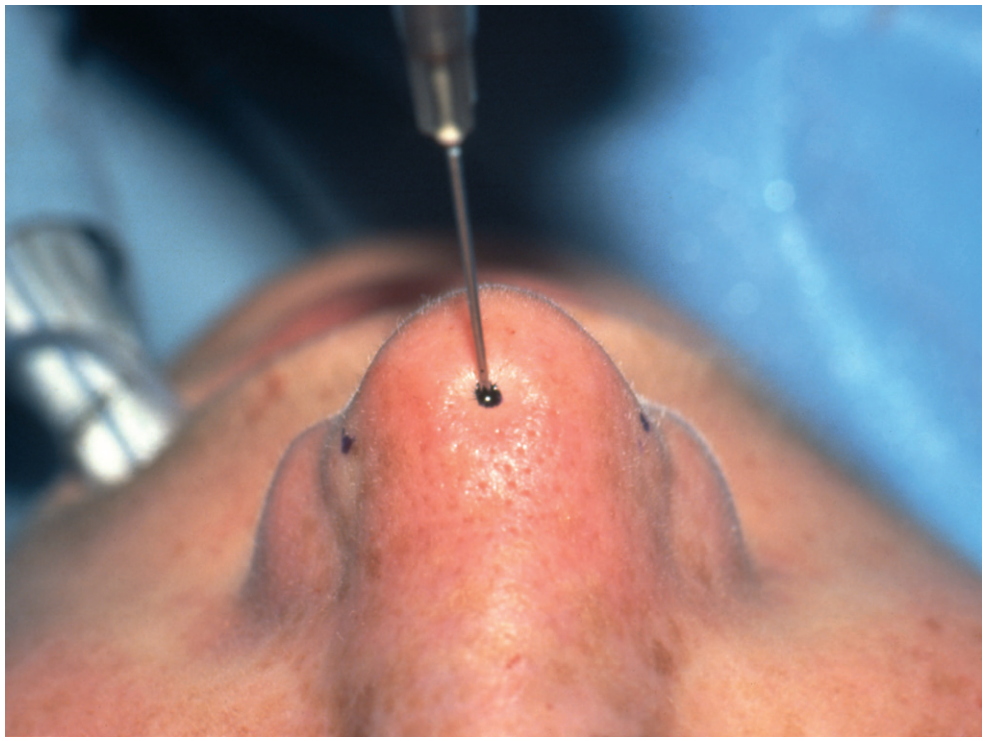


Figure 16.5 A 25 gauge needle is dipped in methylene blue or brilliant green and the supratip break site is tattooed attempting to ensure that the underlying anterocaudal septal angle is marked with the tattooing medium.

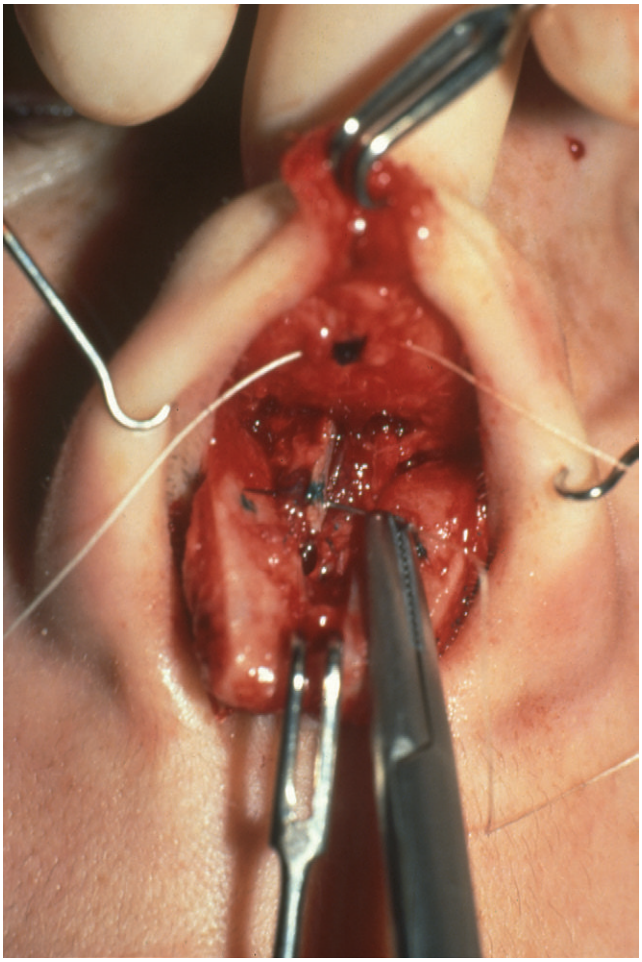


Figure 16.6 A supratip 6-0 poliglecaprone suture is used to approximate the supratip skin to the underlying frame, guided by the tattoo marks.

where overlying skin can appose the nasal lining, is eliminated. This way, essentially every segment of the nasal soft tissue is juxtaposed to cartilage or bone.

The next step in achieving an optimal rhinoplasty outcome in patients with thick skin is the elimination of dead space.[2] A supratip stitch is routinely used on such patients in order to approximate the supratip skin to the underlying dorsal frame. To place this stitch, the skin is draped over the frame and the columellar incision is temporarily approximated using a single stitch of 6-0 fast-absorbable catgut. A 25 gauge needle is dipped in methylene blue or brilliant green and the supratip break site is tattooed, trying to ensure that the underlying anterocaudal septal angle is marked with the tattooing medium (Figure 16.5; see Video 4.24a in Chapter 4). A 6-0 poliglecaprone or 5-0 polyglactin suture is passed through the subcutaneous tissue, catching a small amount of fat (guided by the tattoo mark), passed through the anterocaudal septum (guided by the tattoo mark), and tied gently enough to merely approximate the subcutaneous fat to the underlying frame (Figure 16.6). This stitch

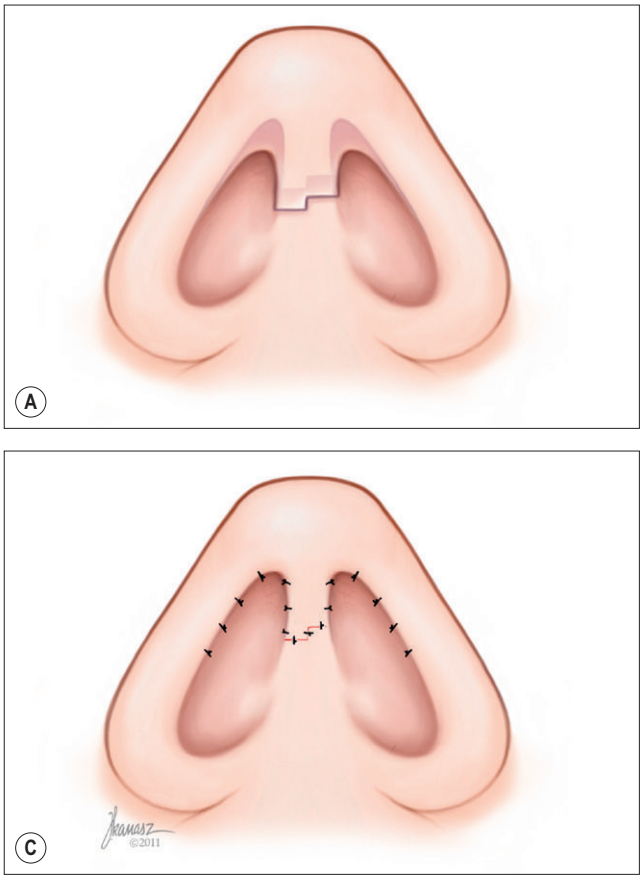


Figure 16.7 Artistic rendering of adjustment of the frame and tip rotation which overlaps the columella incision (A). This can be trimmed over the columella and tapered laterally (B) and repaired with 6-0 fast-absorbable catgut sutures (C).

can cause necrosis of the overlying skin if it is tied too tightly. It is therefore essential to tie the knot very loosely. In patients with significantly thick skin, a similar stitch may be used to approximate the skin to the underlying lateral crura of the lower lateral cartilages. If there is redundant skin overlapping at the columella incision site, it is trimmed and tapered laterally along the original alar incision to minimize the potential for excessive postoperative dead space, which encourages swelling, formation of scar tissue, and loss of tip definition (Figure 16.7). These maneuvers are effective and sometimes even result in excessive definition of the nose as demonstrated in Figure 16.8 (Box 16.1; Animation 16.1). Another patient who exhibits even thicker skin is illustrated in Figure 16.9 (Box 16.2; Animation 16.2).

Animation 16.1 • 16.2

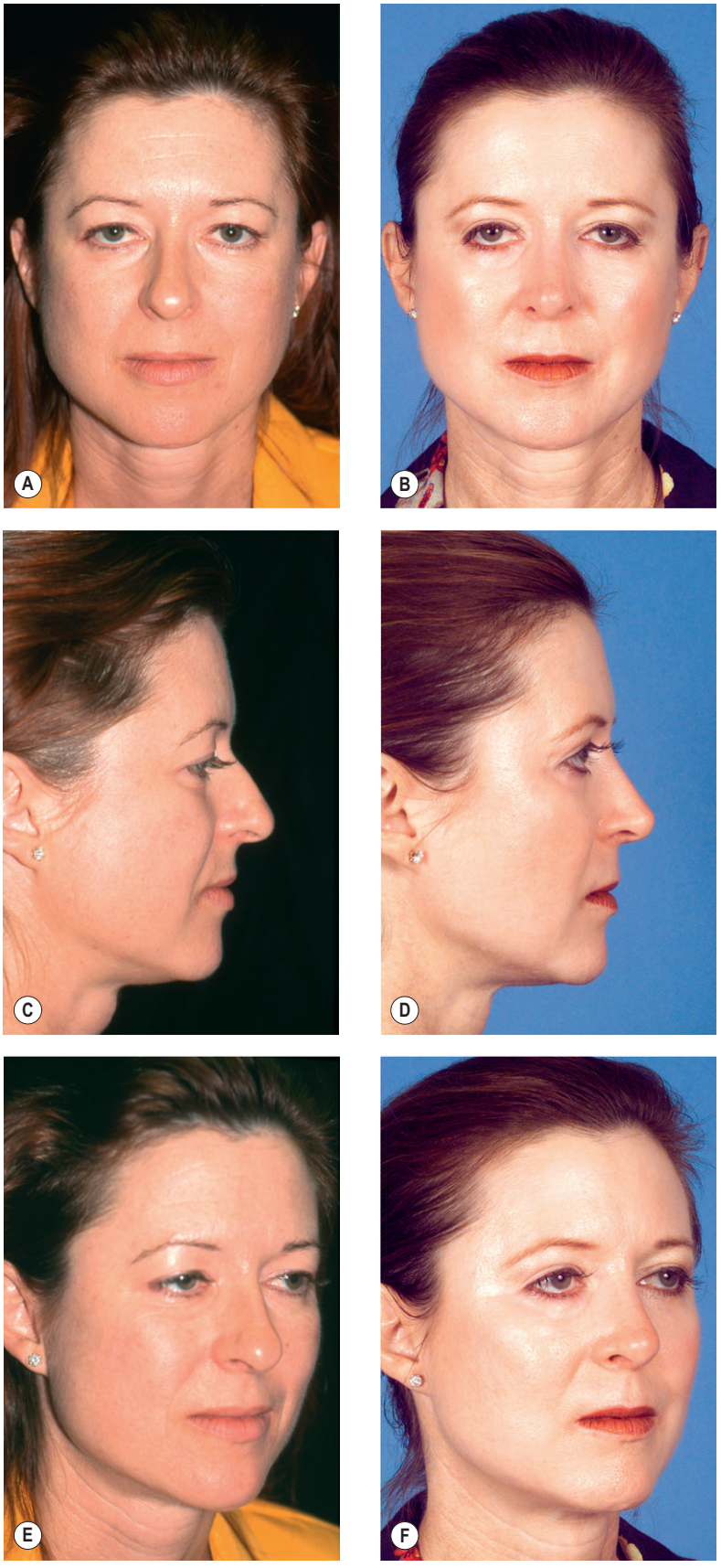
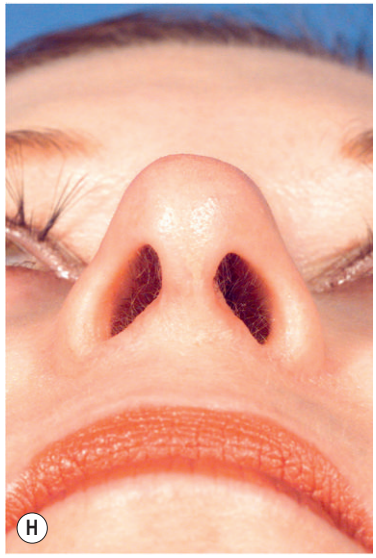
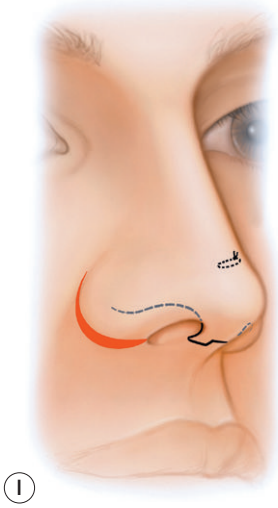


Figure 16.8 A close to optimal nose that is flawed by having too much definition before (A, C, E, G) and 20 months after (B, D, F, H) creation of a firm narrow frame that has resulted in thinning of the soft tissue covering the tip skin. Illustrations demonstrating soft tissue (I) and frame alterations (J).





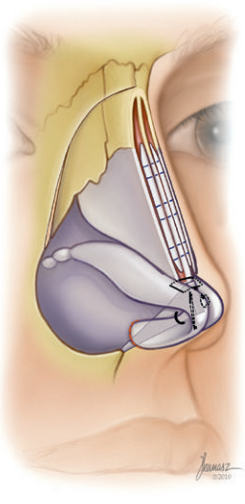


Figure 16.8, cont'd.

BOX 16.1

Surgical Steps: Figure 16.8

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A low-to-low osteotomy was performed bilaterally
- Bilateral spreader grafts were applied
- A columella strut was applied
- The medial crura were approximated
- Transdomal sutures were placed
- A figure-of-eight interdomal suture was placed
- A lateral crura strut was applied
- The caudal septum was resected as a wedge with a proportional amount of membranous septum
- Footplates were resected
- A supratip stitch was used to eliminate the dead space cephalad to the domes
- The alar bases were narrowed with lateral excision bilaterally

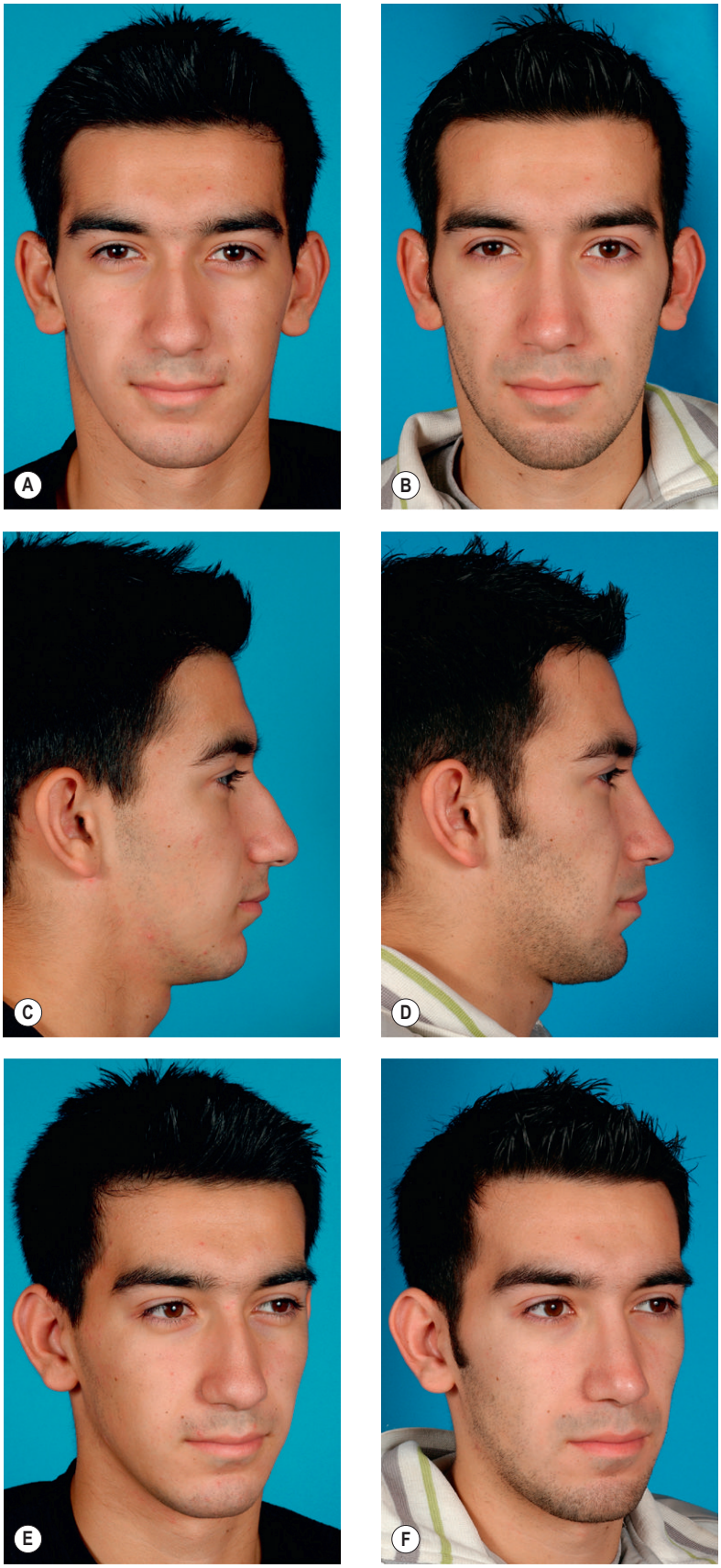


Figure 16.9 Another patient with thick skin before (A, C, E, G) and 3 years following rhinoplasty (B, D, F, H). Illustrations demonstrate the soft tissue and alar rim graft placement (I) and frame alterations (J).

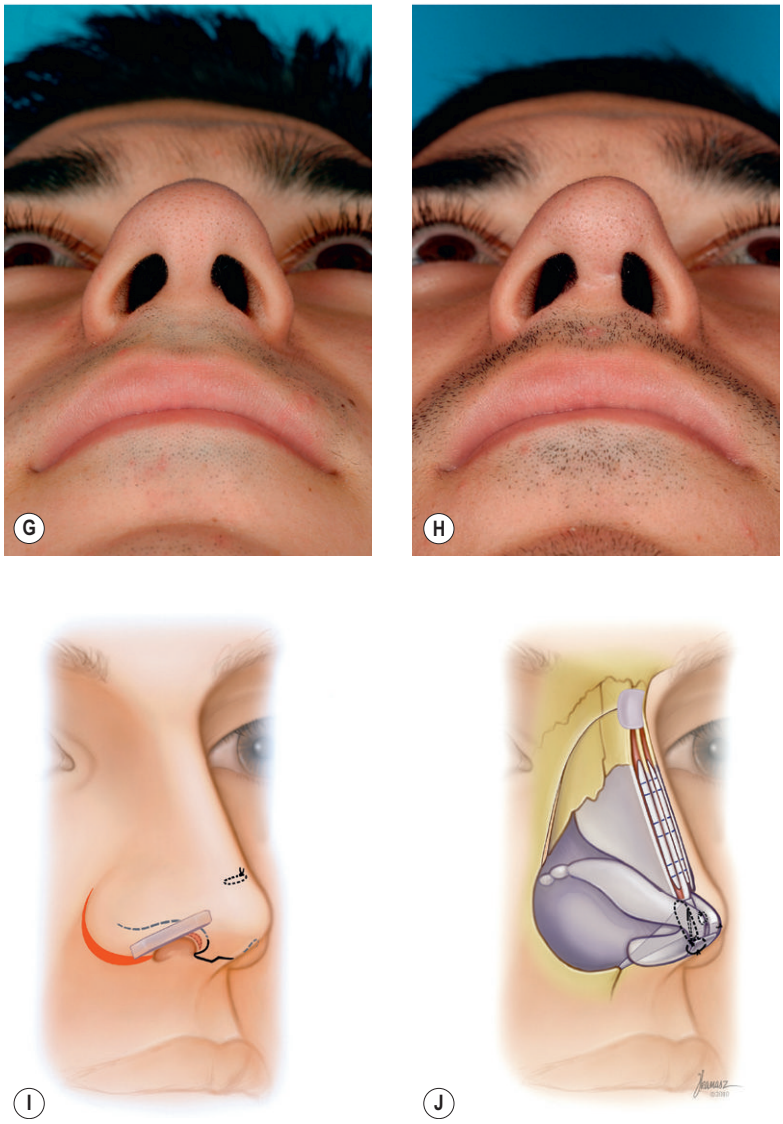


Figure 16.9, cont'd.

BOX 16.2

Surgical Steps: Figure 16.9

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was carried out
- A low-to-low osteotomy was done bilaterally
- Bilateral spreader grafts were applied
- A columella strut was applied
- Transdomal sutures were placed
- A figure-of-eight interdomal suture was placed
- A subdomal graft was applied
- The caudal septum was resected as a wedge with a proportional amount of membranous septum
- The upper lateral cartilages were shortened bilaterally
- The radix was augmented
- A supratip stitch was used to eliminate the dead space cephalad to the domes
- The alar bases were narrowed with combined excision bilaterally
- Alar rim grafts were applied bilaterally
- A tip rotation suture was placed
- A lobule graft was applied
- The soft triangle lining was removed bilaterally

If the patient develops supratip fullness postoperatively, the area is injected with 0.1–0.2 ml triamcinolone 40 µg/ml every 6 weeks until the intended definition is achieved. Triamcinolone is injected into the interface between the dorsal frame and the soft tissues and not into the dermis. Otherwise, it causes irregularity and telangiectasis. The nose is taped routinely, as often as is feasible, for a period of 30–60 days. The taping should incorporate the supratip area and avoid the tip itself (Figure 16.10).

Figure 16.10 Demonstration of taping to improve tip definition and minimize the supratip deformity.

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CHAPTER 17

Correcting Deviated Noses, Septoplasty and Turbinectomy

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Pearls

- Commonly, the deviated nose and septum are associated with other conditions such as sinus headaches, frequent sinus infections and migraine headaches.
- Nasal deviation and valvular dysfunction following facial paralysis offers the best evidence regarding the role of the soft tissues in nasal symmetry and valve function.
- A longstanding shift of the midline structures cannot be simply corrected with an osteotomy and forceful repositioning. It requires component separation and realignment of all of the structures individually, including the nasal bones, the septum and the upper lateral cartilages.
- Mid-vault deviation consistently accompanies anterior, and commonly, mid and posterior septal deviation.
- Of the six classes of septal deviation, the most common is the septal tilt in which the septum itself has no significant underlying curvature but it is tilted to one side because the caudal septum is dislodged to one side of the vomer bone (often the left side).
- The C-shaped anteroposterior deviation is the second most common type of septal deviation.

- A persistent unilateral obstruction of the airway is a reliable indicator of a mechanical airway compromise.
- A negative history of airway obstruction is not a reliable indication of a patent airway since the patients may not have a basis for comparison.
- Many female patients with nasal deviation pluck their eyebrows differentially to camouflage the nasal asymmetry, which can be misleading. On these patients, the mid-eyebrow point should not be used as the upper face midline.
- In patients who have frequent sinus headaches, sinus infections, or migraine headaches, a CT scan may disclose pathology such as septal deviation, sinusitis, concha bullosa, septa bullosa, contact points and Haller's cell.
- A medial deviation of the nasal bone requires an outfracture of the bone that will be supported with an extended spreader graft to avoid medial shift of the bone while it is healing.
- A longstanding deviation of the anterior nose will require separation of the upper lateral cartilages from the midline and repositioning.
- A cardinal step in correction of most deviations, especially tilt, is disengagement of the dislodged caudal portion of the retained alar strut from the vomerine groove and anterior nasal spine, removal of the redundant, overlapping cartilage and repositioning and fixation to the nasal spine periosteum, as long as one is confident that the anterior nasal spine is positioned in the midline.
- If the anterior nasal spine is deviated, it has to be osteotomized and repositioned.
- Components of correction of anteroposterior C-shaped deviation include removal of the posterocephalic portion of the septum and the deviated portion of the perpendicular plate and vomer bone, repositioning of the posterocaudal septum, and rarely, scoring of the septum and placement of splints on either side of the septum.
- Correction of C-shaped cephalocaudal deviation requires removal of the posterocephalic portion of the septum, release of caudal tension and repositioning the L-frame, scoring the concave side if release of tension would not correct the deviation.
- Whenever the septum is scored, application of extramucosal stents is necessary to control and maintain the septum straight while it is healing.
- For correction of S-shaped deviation, the posterocephalic portion of the septum is removed and the caudal portion of the L-frame is repositioned, the concave side is scored, if necessary, and extramural splits and spreader grafts are applied.

- If an inadvertent tear in the mucoperichondrium is unilateral, it will not be consequential. If the tear is bilateral but the perforations are not apposing, the mucosa may still heal without persistent perforation. When the tears are apposing, a straight piece of septal cartilage or perpendicular plate is replaced and the extramural stents are applied for two to three weeks.
- The remaining caudal dorsal deviation can be corrected using a septal rotation suture. This is a horizontal mattress suture placed through the upper lateral cartilages and the septum more cephalad on the side that the structures will be rotated towards.
- A deviated caudal nose is often associated with disparity in the length of the lower lateral cartilage. Depending on the tip projection, one has to either elongate the short lower lateral cartilage or shorten the long side to rotate the tip to the midline.
- The notion that the turbinates may shrink after correction of the deviated septum is ill-conceived and illogical. Rather than shrinking, the enlarged turbinates may shift the septum off the midline.

One of the most frustrating, and at the same time, most rewarding aspects of rhinoplasty is dealing with the deviated nose. Almost invariably, a deviated nose is synonymous with some degree of nasal dysfunction. The magnitude of deviation governs the intensity of the symptoms in most patients. However, on rare occasions, a patient with a significant deviation of the nose may have minimal or no symptoms, and the reverse may also be true: a patient with minimal deviation may have a significant amount of nasal airway compromise. Commonly, the deviated nose and septum are associated with other conditions such as sinus headaches, frequent sinus infections, and migraine headaches, the recognition of which can lead to proper management and more gratifying outcomes. Residual or persistent deviation is often related to a failure to recognize the full extent of the structural deviation. Most deviations involve several structures of the nose and if one fails to correct all the abnormalities, the outcome is often disappointing. Therefore, it is essential to conduct a circumspect examination of the entire face, the external nasal frame, and the internal nasal structures.

Pathology

The soft tissue envelope with its underlying perinasal musculature plays a major role in maintaining the symmetry and patency of the valvular mechanism. Nasal deviation and valvular dysfunction following facial paralysis offers the best evidence regarding the role of the soft tissues in nasal symmetry and valve function. The perinasal musculature was discussed in Chapter 1.

The septum constitutes the main central support for the nose, which is composed of the perpendicular plate, the quadrangular cartilage and the vomer bone (see Figure 1.17 in Chapter 1). The perpendicular plate of the ethmoid is in continuity with the posterior edge of the quadrangular cartilage and both structures are aligned caudally with the vomer. The most anterocaudal portion of the septal cartilage also rests on the maxillary crest in a tongue-and-groove relationship. This point of articulation is unique in that the perichondrium of the cartilage is only partially contiguous with the periosteum of the crest, allowing a decussation of fibers that joins the contralateral perichondrium.[1] This configuration can make a submucoperichondrial dissection tedious. Starting the dissection from the posterior caudal septum and continuing it in the anterior direction may overcome the difficulty. This relationship between the cartilage and the bone renders this portion of the septum susceptible to post-traumatic displacement of the cartilage from the groove of the crest, correction of which is paramount for the successful straightening of the septum and consequently the external nose.

The area of overlap at the junction between the cephalic upper lateral cartilages and the nasal bones, which makes up the keystone area, is characterized by a firm adherence between these structures. Trauma to the nasal bones can shift this entire unit. A longstanding shift of the midline structures cannot be simply corrected with an osteotomy and forceful repositioning. It requires component separation and realignment of all the structures individually, including the nasal bones, the septum, and the upper lateral cartilages.

Adjustment of the size of the turbinates plays a cardinal role in the restoration of nasal function following correction of nasal deviation. The inferior turbinate occupies a large portion of the nasal airway and can account for up to two-thirds of the total airway resistance.[2] The turbinates are covered with an erectile mucosal tissue composed of pseudostratified ciliated columnar epithelium. The submucosa contains many seromucinous glands and vascular channels containing cavernous sinusoids. These channels are under the influence of the autonomic nervous system and thus serve as the end target for decongestant medication. The sympathetic system regulates the resistance vessels (and therefore blood flow) and the parasympathetic system regulates the capacitance vessels (and therefore blood volume) of the nasal mucosa. The submucosa also contains large numbers of mast cells, eosinophils, plasma cells, lymphocytes, and macrophages. Thus, chronic inflammation secondary to stimulation of these abundant proinflammatory cellular constituents can lead to fibrous deposition and chronic hypertrophy of the turbinate.[1] Long standing deviation of the septum, especially if it occurs at an early age, results in enlargement of the inferior and/or middle turbinate facing the concave side of the septum (Figure 17.1).

Figure 17.1 Longstanding deviation of the septum to the patient's right has resulted in enlargement of the left turbinate.

The internal nasal valve accounts for approximately 50% of the total airway resistance and is the narrowest segment of the nasal airway.[3,4] It is formed by the angle between the junction of the nasal septum and the caudal margin of the upper lateral cartilage and is typically 10–15°, as mentioned in earlier chapters[5] (see Figure 1.13 in Chapter 1).

The importance of the nasal valves in nasal airflow cannot be overstated and has been studied extensively.[6–9] The internal nasal valve is a crucial regulator of nasal airflow dynamics and should be preserved and/or reconstructed during rhinoplasty. Injury and destabilization of this complex, by either surgery or trauma, may result in collapse and subsequent nasal airway obstruction. The external nasal valve, which serves as the entrance to the nose, is formed by the caudal edge of the lateral crus of the lower lateral cartilage, the soft tissue alae, the membranous septum, and the sill of the nostril (see Figure 1.13 in Chapter 1). This is an occasional site of obstruction secondary to extrinsic factors, such as foreign bodies, or intrinsic factors, such as weak or collapsed lower lateral cartilages, a loss of vestibular skin, or cicatricial narrowing.[5] Normal function of this valve depends on the structural integrity of the lower lateral cartilages, the perinasal musculature,

and adequate soft tissue coverage. Functional compromise can occur with encroachment of the nasal spine, and especially the footplates, into the nostril opening. Architecturally weak lateral crura further compound the effects of a widened columella.[10] Other causes for external valve collapse include facial nerve palsy, pinched alar deformity, and postsurgical vestibular stenosis secondary to synechiae and over-resection of the lower lateral cartilages.

The septum and the nasal bones control the direction of the nose. Thus, deviation of the nose can result from misalignment of one or the other, or a combination of both. Often, the nasal bones follow the direction of the deviated septum. However, these structures may move independently. Mid-vault deviation consistently accompanies at least anterior and commonly mid- and posterior septal deviation. Deviation of the lower nose may involve the caudal septum, anterior nasal spine, and lower lateral cartilages. Previous studies by the author's team and others have detailed and categorized the types of septal deviation.[5,11–14]

There are six classes of septal deviation.[11] The most common type is a septal tilt, in which the septum itself has no significant underlying curvature but is tilted to one side because the caudal septum is dislodged to one side of the vomer bone (Figure 17.2). In most cases of septal tilt, the internal dislodgement of the septum is to the left and the external deviation of the nose is to the right. This is usually accompanied by an enlargement of the inferior turbinate ipsilateral to the external deviation.

C-shaped anteroposterior deviation is usually associated with deviation of the vomer plate. External reflection of the anteroposterior C deviation is often similar to the septal tilt (Figure 17.3). In addition to the enlargement of the inferior turbinate, the middle turbinate is often enlarged as well.

C-shaped cephalocaudal deviation presents externally as a curved appearance of the nasal dorsum. The most common form of this deviation is the reverse C with the curve facing the patient's right (Figure 17.4). The opposing inferior, and often the middle, turbinate is enlarged.

S-shaped anteroposterior deviation is defined by two opposite curvatures in continuity in the anteroposterior direction (Figure 17.5). Externally, the anteroposterior deviation will present with a shift of the nose to the left or right. Rarely, the anterior portion of the nose may look totally straight.

S-shaped cephalocaudal deviation is similar to the previous type except that the curvatures are in the cephalocaudal direction (Figure 17.6). Inferior and middle turbinate enlargement is common with both types of S-shaped deviations. The external nose follows the pattern of the septal deviation.

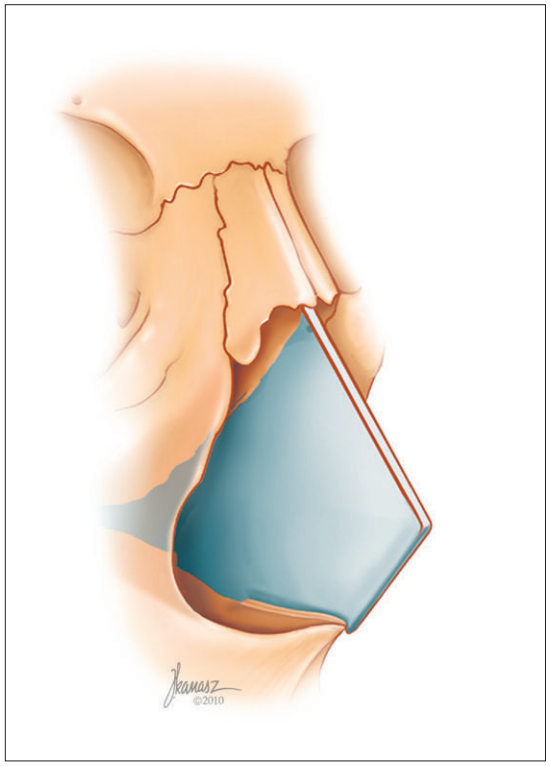


Figure 17.2 An illustration of a septal tilt where the septum is dislodged to the left side of the maxillary crest of the vomer bone and the anterior septum is deviated to the right.

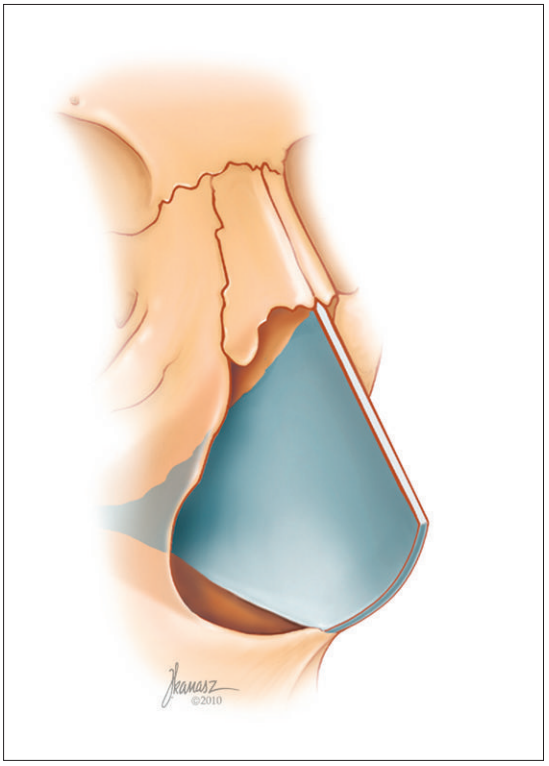


Figure 17.3 An illustration of a C-shaped anteroposterior septal deviation.

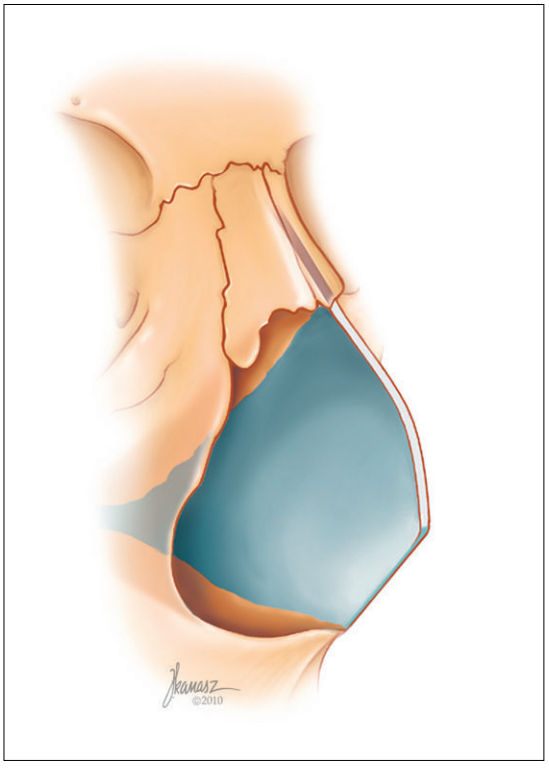


Figure 17.4 An illustration of C-shaped cephalocaudal deviation of the septum.

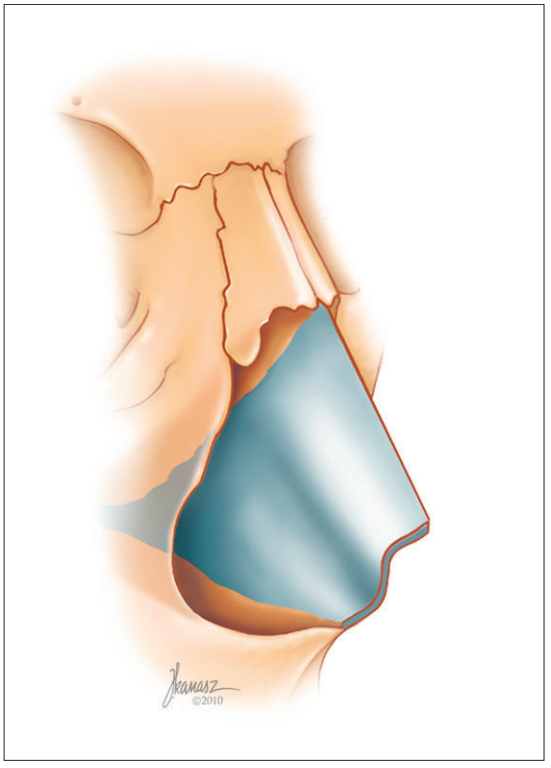


Figure 17.5 An illustration of S-shaped anteroposterior septal deviation.

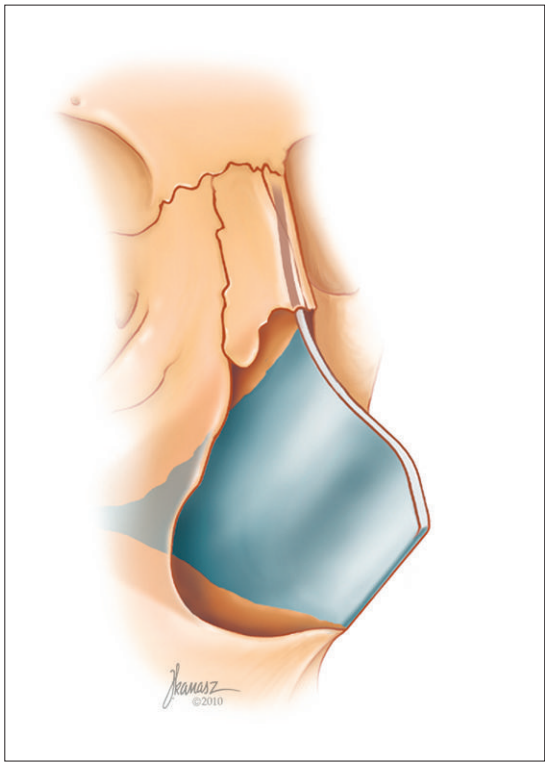


Figure 17.6 An illustration of S-shape cephalocaudal deviation the septum.

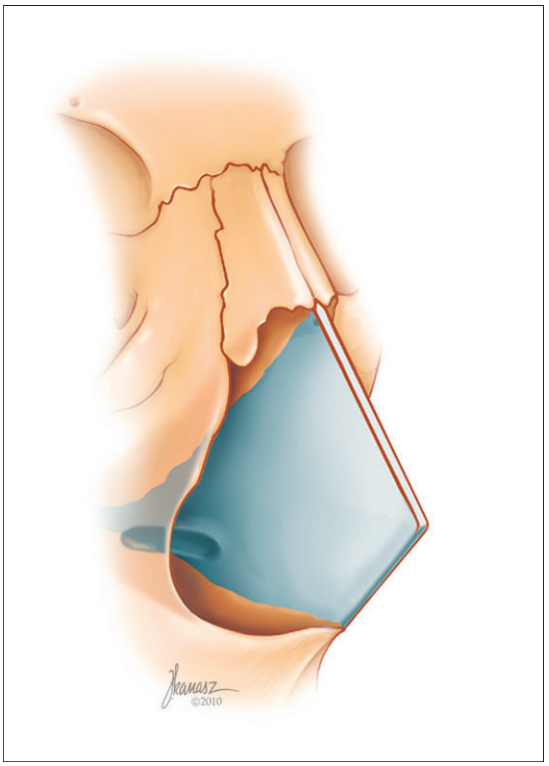


Figure 17.7 An illustration of a localized deviation and septal spur.

The last type of septal deviation is a localized deviation or spur. This is a purely functional problem and has no translation to the external shape of the nose (Figure 17.7).[10] Turbinate enlargement is not common with this type of deviation.

Patient Assessment

A detailed patient history of nasal trauma, previous nasal surgery, airway complaints, and allergies is obtained. Cyclical nose obstruction is a physiological change. A persistent unilateral obstruction of the airway is a more reliable indicator of mechanical airway compromise. On the other hand, a negative history of airway obstruction is not a reliable indication of a patent airway, since the patient may not have a basis for comparison. If the obstructive symptoms occur during quiet and deep inspiration, this indicates a fixed obstruction such as an enlarged turbinate, a septal deviation, or a mass.

Figure 17.8 Detection of deviation of the facial structures, especially the chin, is crucial to successful correction of the deviated nose.

However, obstruction that occurs only during deep inspiration may indicate an incompetent internal or external nose valve.

Attention to detail and careful observation are vital in order to garner the critical information necessary to arrive at the correct diagnosis and an effective surgical plan. Observation of the external nose and face should include attention to oral or nasal breathing. Mouth-breathing can be continuous or intermittent. Additionally, the face should be assessed for overall symmetry, canting of the plane of occlusion, and alignment of the nose with the rest of the facial structures (Figure 17.8). The chin position should be noted in relation to the upper face midline, the upper and lower lips. and the midline of the upper and the lower incisors. The midline should be set at the intercanthal line rather than the intereyebrow plane. Many female patients with nasal deviation pluck their eyebrows differentially to camouflage the nasal

Figure 17.9 A patient with nasal deviation who has tried to camouflage her nasal asymmetry by differential plucking of her eyebrows.

Figure 17.10 An intraoral view of a patient with a high, narrow palate.

asymmetry, which can be misleading (Figure 17.9). On these patients, the mid-eyebrow point should not be used as the upper face midline. Examination of the oral cavity may reveal a very high and narrow palatal arch that encroaches on the nasal airway. Such patients commonly have a very constricted nasal airway and require special care to maintain and perhaps widen it (Figure 17.10).

Facial nerve function is also assessed, since paralysis of the perinasal muscles can cause nasal airway obstruction. The nose is then observed zone by zone for deviated structures, including the nasal bones, the anterior septum, the upper and lower cartilages, and the lower lateral cartilages, similarly to the procedure described in Chapter 2. A basilar view with the head tilted back may disclose columella, tip, footplate, nostril, and alar base asymmetry. An

overhead view is the most helpful view for detection of external nasal deviation.

Palpation is critical in assessing the three-dimensional frame of the nose. This portion of the examination should include palpation of the nasal bones, upper lateral, and lower lateral cartilages, as well as the membranous septum, the caudal cartilaginous septum, and the anterior nasal spine. Palpation and percussion over the frontal, ethmoid, and maxillary sinuses is performed to elicit tenderness that may be indicative of inflammation of the underlying structures and sinuses.

The patient's nostril is occluded one side at a time and the patient is asked to inhale normally and then deeply. If nasal valve incompetence is suspected, the Cottle test is employed. While the patient breathes quietly, the nostril is supported with a nasal speculum or the cheek is retracted laterally to open the nasal valve. If breathing is improved, this represents a positive Cottle test and is valid evidence of nasal valve incompetence. Another maneuver allowing independent evaluation of the external and internal nasal valves is simply to use a cotton-tip applicator to stent the airway during light and deep inspiration, as discussed in Chapter 2.

The internal nose is examined for detection of septal deviation, enlarged turbinates, synechiae, perforation, spurs, and contact between the turbinates and the septum. Any crusting, purulence, ulceration, or presence of polyps should be noted. The color and size of the turbinates are also documented, as a pale turbinate mucosa may indicate allergy, whereas erythematous mucosa may indicate an infection or inflammatory process, implying rhinitis of some sort.

The above examination maneuvers should be repeated before and after vasoconstriction of the nasal mucosa using 0.25% phenylephrine or 1% ephedrine sulfate. These agents can be delivered via an aerosolized misting system or topically with cottonoid pledgets. Posterior rhinoscopy is often helpful in symptomatic patients. Visualization of the posterior nasal airway is best achieved using a 0° or 30° nasal endoscope.

Life-sized photographic and cephalometric analysis, as described above, is used to further confirm the findings of the physical examination.

Radiology

In patients who have frequent sinus headaches, sinus infections, or migraine headaches, review of a computed tomography scan may prove extremely useful in detection of pathology that cannot be visualized during physical examination such as sinusitis, concha bullosa, septa bullosa, Haller's cell and contact points.

Surgical Treatment of the Deviated Nose

Successful correction of a deviated nose requires full recognition of the existing pathology and complete elimination of deviation from all components of the nose. The deviation can be in the nasal bones, the upper lateral cartilages, the caudal dorsum, or the basal unit of the nose. Often a combination of deviations coexist.

Correction of Deviated Nasal Bones

The deviation in the nasal bone can be unilateral or bilateral. Unilateral deviation is corrected with an onlay graft if it is not of functional consequence. This is accomplished using a layer of intact septal cartilage graft or a thin layer of diced cartilage or soft tissue graft. The outcome of the former is more predictable.

Under general anesthesia, the face is prepped and nasal vasoconstriction is achieved using the double injection method described in Chapter 4. An intercartilaginous incision is made and the target nasal bone is exposed. The periosteum is elevated using a Joseph's periosteal elevator in a limited fashion. Septal or conchal cartilage graft in the form of a single or double layer gently crushed, depending on the degree of the nasal bone shift, diced cartilage, or a layer of soft tissue, such as dermis or fascia graft, is applied in the subperiosteal plane and molded in place. The incision is repaired loosely to allow for drainage.

Usually, however, a visible shift of the nasal bone is associated with medial transposition of the upper lateral cartilages, which compromises the ipsilateral internal valve function. With this scenario, a unilateral outfracture of the nasal bone produces a better functional and aesthetic outcome. Through a small vestibular incision at the pyriform aperture, the periosteum is elevated using a Joseph's periosteal elevator. A low-to-low osteotomy is performed and the nasal bone is outfractured. Often, the bone union after the previous fracture is incomplete and the osteotomy can readily be completed as long as the osteotome is advanced through the old osteotomy site. To avoid return of the nasal bone to its previous position, placement of a spreader graft can be very useful. An incision about 3 mm long is made in the mucoperichondrium immediately caudal to the junction of the upper lateral cartilage and the septum anteroposteriorly. The septal elevator is used to create a pocket large enough to accommodate the spreader graft. The graft is inserted between the septum and the upper lateral cartilage and advanced under the nasal bone. Additionally, a piece of folded Adaptic™ or Surgicel™ saturated in bacitracin ointment is placed between the nasal bone and the septum and kept in position for at least 1 week. During this time, the patient is maintained on systemic antibiotics.

Bilateral nasal bone deviation can only be corrected with bilateral osteotomy and repositioning of the deviated nasal bones. This may require a septoplasty

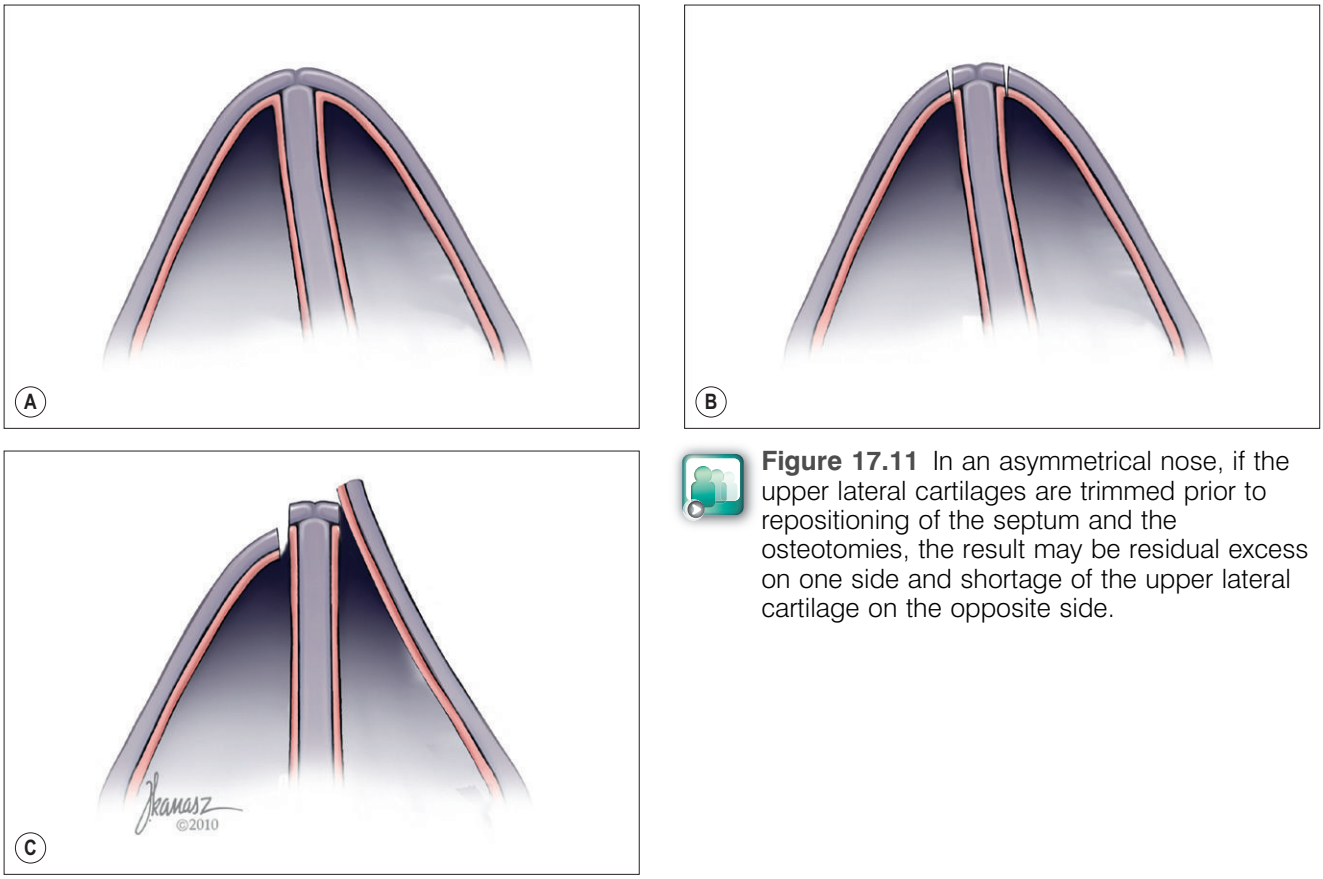


Figure 17.11 In an asymmetrical nose, if the upper lateral cartilages are trimmed prior to repositioning of the septum and the osteotomies, the result may be residual excess on one side and shortage of the upper lateral cartilage on the opposite side.

as well. If, in addition to the deviation of the nasal bones, the midvault is deviated, this mandates a septoplasty, along with separation of the upper lateral cartilages from the septum, which is discussed in detail below. Depending on the type and nature of the deviation, the nasal bones are either osteotomized on each side simultaneously or both nasal bones are osteotomized laterally and cephalically without a medial osteotomy and are shifted together as a single unit. This osteotomy is technically challenging and seldom corrects the deviation effectively. Most deviated noses can be effectively corrected using the bilateral independent controlled osteotomy described in Chapter 4, along with septoplasty.

Deviation of the midvault is synonymous with deviation of the septum. This type of deviation can rarely be corrected simply with a camouflage graft. In the majority of cases, a thorough correction of septal deviation is necessary to correct the midvault deviation. Additionally, the upper lateral cartilages have to be separated from the septum and differentially trimmed after repositioning of the septum to the midline and completion of the osteotomies (Figure 17.11; Animation 17.1).

Animation 17.1•

Correction of the deviated septum can be accomplished either using an open technique, if a concomitant rhinoplasty is planned, or through an L-shaped (Killian) incision if the correction of the deviated septum is the sole surgical goal. When the open technique is used, the mucoperichondrium is elevated

on the left side of the septum starting from the caudal septal angle. A small incision in the mucoperichondrium may be needed anteriorly to facilitate opening into the correct subperichondrial plane. Once in the correct plane with the glistening, grayish cartilage in view, the blunt end of a periosteal elevator is used to raise the mucoperichondrial flap. Dissection is continued posteriorly, cephalically, and caudally. When the dissection reaches the junction of the quadrangle cartilage and the vomer bone, it may be easier to start the dissection from the posterocaudal septum and extend it anteriorly. The fibrous attachments are firm anterocaudally, as mentioned earlier, rendering the dissection arduous. If a closed technique is deemed appropriate, an L-shaped incision is made in the left mucoperichondrium (for the right-handed surgeon), the subperichondrial plane is entered, and the mucoperichondrium is elevated on the left side. From this point on, the technique is the same regardless of whether an open or a Killian incision is used. The L incision is taken through the quadrangular cartilage using the sharp end of the septal elevator, leaving an L strut at least 15 mm wide anteriorly and 10 mm caudally. The mucoperichondrium is elevated posterior and cephalad to the L incision only. The caudal portion of the septal cartilage is gently separated from the maxillary crest of the vomer bone using the sharp end of the septal elevator. Similarly, the sharp end of the septal elevator is used to separate the cartilage from the perpendicular plate of the ethmoid bone and the cartilage is removed. The deviated portions of the vomer bone and the perpendicular plate are removed as extensively as necessary to eliminate internal deviations posteriorly. The remaining portion of the septoplasty technique depends upon the type of septal deviation (see videos 4.12, 4.13, 4.15 in Chapter 4).

Septal Tilt

Septal tilt is corrected by initially removing the posterocephalic portion of the septum, leaving an L-strut septum anteriorly and caudally (Figure 17.12A). A cardinal step is disengagement of the dislodged caudal and posterior portion of the retained L strut from the vomerine groove and anterior nasal spine. The second crucial step is removal of the overlapping redundant caudal portion of the septal cartilage (Figure 17.12B) to provide a 'swinging door'-type free movement of this cartilage (Figure 17.12C; Animation 17.2). It is imperative to reposition and often fix the septum to the periosteum of the anterior nasal spine (see Videos 4.13c, 4.13d in Chapter 4). Fixation is achieved with a figure-of-eight suture using 5-0 PDS. Prior to repositioning of the septum, it is essential to ensure that the anterior nasal spine is in the midline. Otherwise, the free caudal septum will be fixed to a deviated foundation. This is accomplished by palpation of the anterior nasal spine between the right thumb and index finger (for a right-handed surgeon). Even the slightest deviation can be detected very readily using this maneuver. If the anterior nasal spine is deviated, it is greenstick-fractured and repositioned (Figure 17.13; Animation 17.3). This approach ensures consistent correction of the septal tilt type nasal deviation (Figure 17.14; Box 17.1; Animation 17.4).

Animation 17.2• 17.3• 17.4

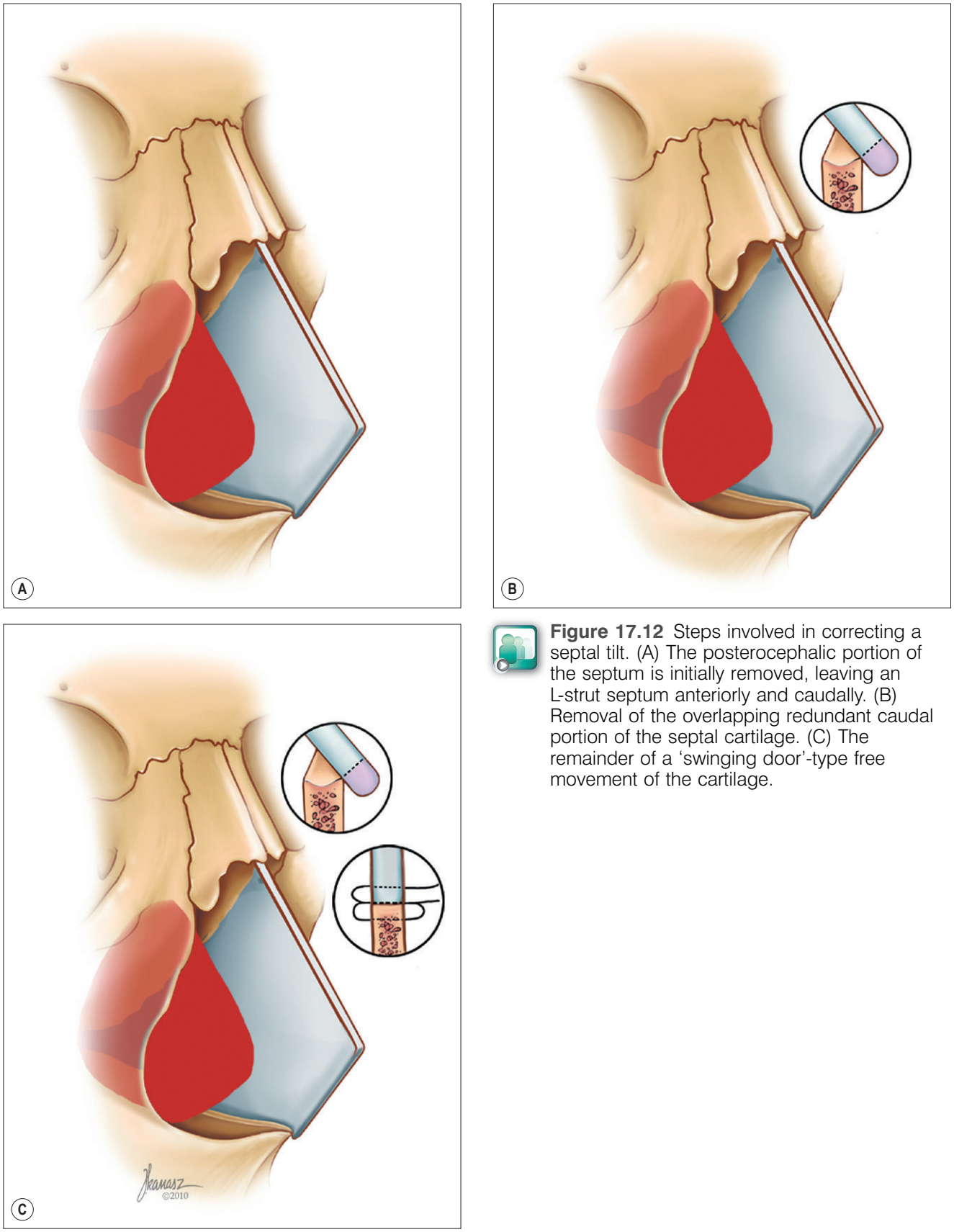
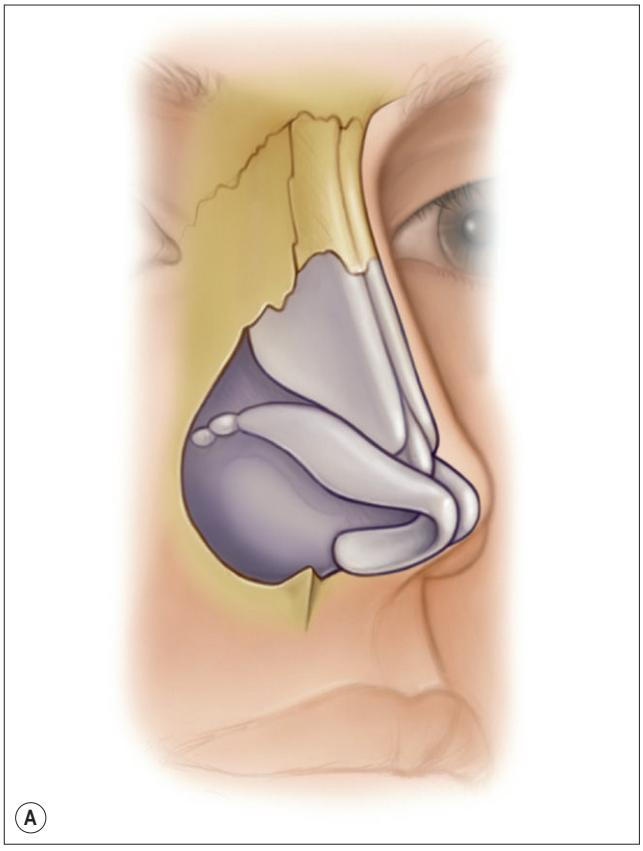
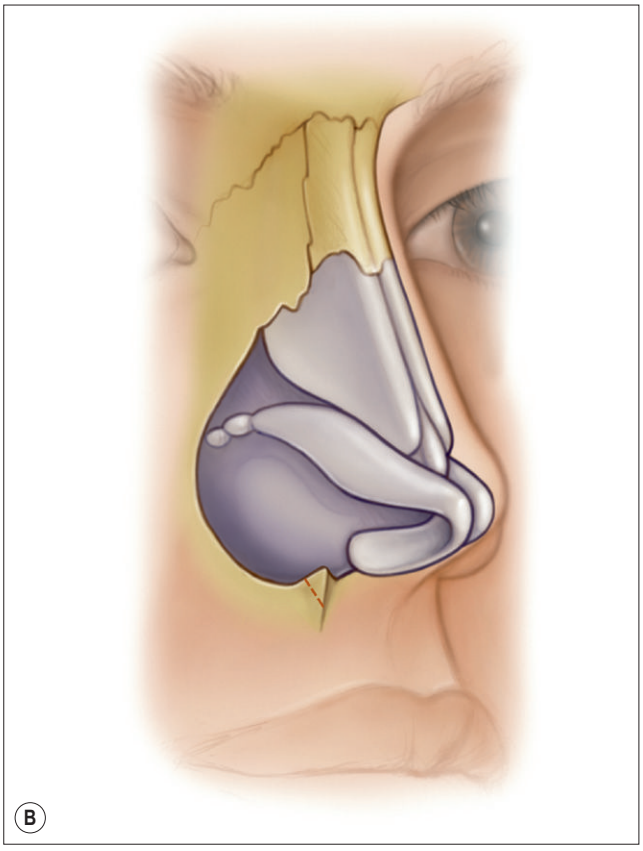


Figure 17.12 Steps involved in correcting a septal tilt. (A) The posterocephalic portion of the septum is initially removed, leaving an L-strut septum anteriorly and caudally. (B) Removal of the overlapping redundant caudal portion of the septal cartilage. (C) The remainder of a 'swinging door'-type free movement of the cartilage.





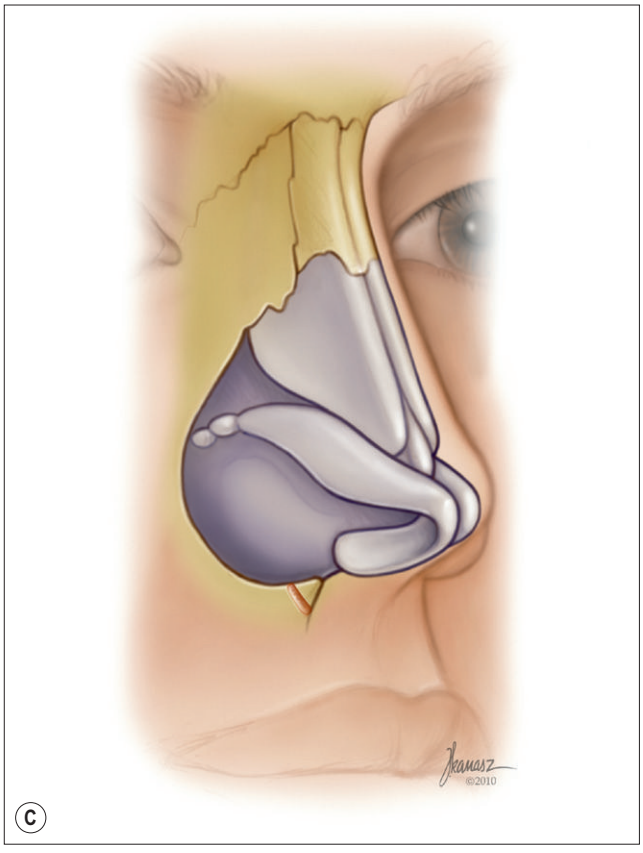


Figure 17.13 A deviated nasal spine can be repositioned by means of an osteotomy in the form of a greenstick fracture (A, B, C).

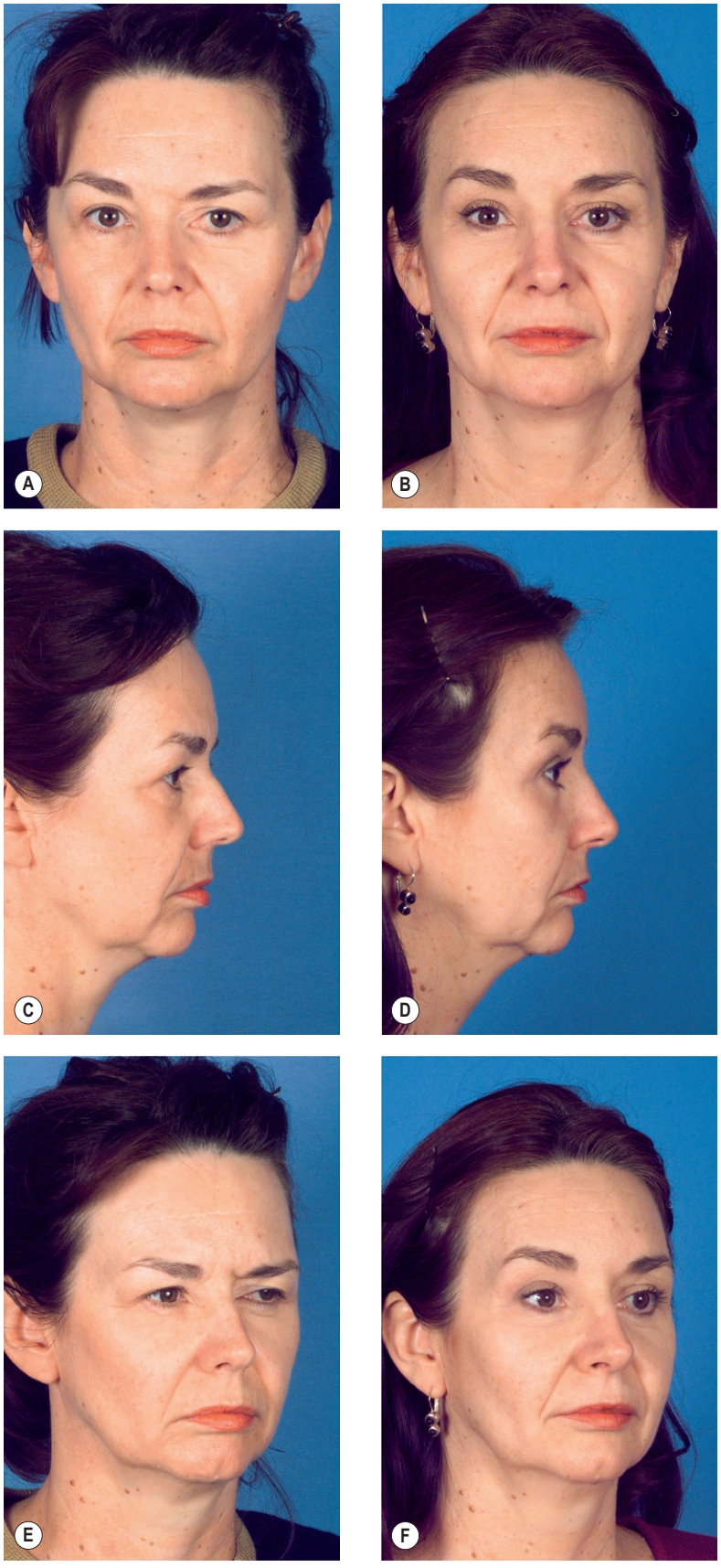
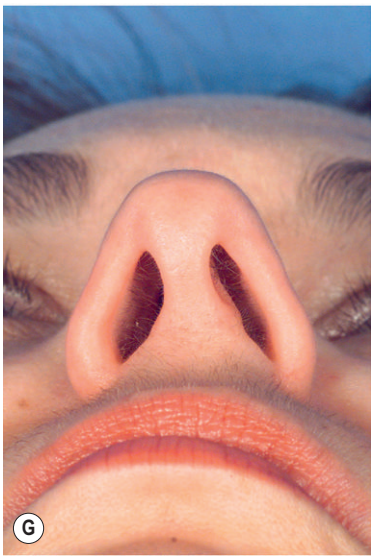
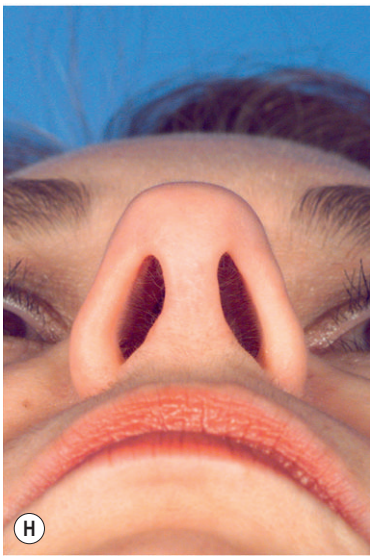
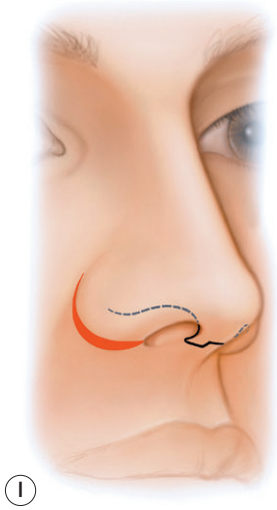


Figure 17.14 A patient with septal tilt to the right internally and to the left externally before (A, C, E, G) and 1 year after correction of the deviation (B, D, F, H). Note the repositioning of the nasal spine and base of the columella on the basilar view. Illustration of the technical steps for soft tissue (I) and frame alterations (J).







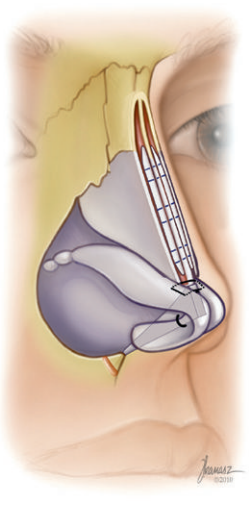


Figure 17.14, cont'd.

BOX 17.1

Surgical Steps: Figure 17.14

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- Bilateral spreader grafts were applied
- A columella strut was applied
- The medial crura were approximated
- A lateral crura spanning suture was placed
- The nasal spine was osteotomized and repositioned in the midline
- The alar base was narrowed with lateral excision on the left

Correction of Anteroposterior C-shaped Deviation

Correction of this deformity first requires resection of the posterocephalic portion of the septum, as described above (Figure 17.15A). An osteotomy of the anterior nasal spine and residual vomer plate is often necessary in order to reposition this structure in the midline (Figure 17.15B). A partial disjunction of the perpendicular plate of the ethmoid and quadrangle cartilage is carried out only if deemed necessary to correct the deviation in the anterior and cephalic third of the nose. Commonly, release of tension in the cartilage by removal of the posterior and caudal portion of the cartilage and creation of a swinging-door-type movement will eliminate the C-shaped curvature in the cartilage. Otherwise, the L-shaped frame is scored in a cephalocaudal direction on the concave surface (Figure 17.15C; Animation 17.5). However, scoring seldom becomes necessary. Since the final outcome of scoring is not predictable, bilateral extramucosal stents are placed (Simple Stent, Supramed) and fixed in position with a through-and-through suture in order to mold the cartilage while it is healing. Stents are left in position for at least 2 and preferably 3 weeks (Figure 17.16).

Animation 17.5•

Anterior deviation of the nose is corrected by separation of the upper lateral cartilages from the septum, osteotomy, repositioning of the frame, differential trimming of the upper lateral cartilages, and placement of spreader grafts, often without scoring and rarely with scoring (Figure 17.17; Animation 17.6). This technique often predictably corrects the anteroposterior C-type deviation very successfully (Figure 17.18; Box 17.2; Animation 17.7).

Animation 17.6• 17.7

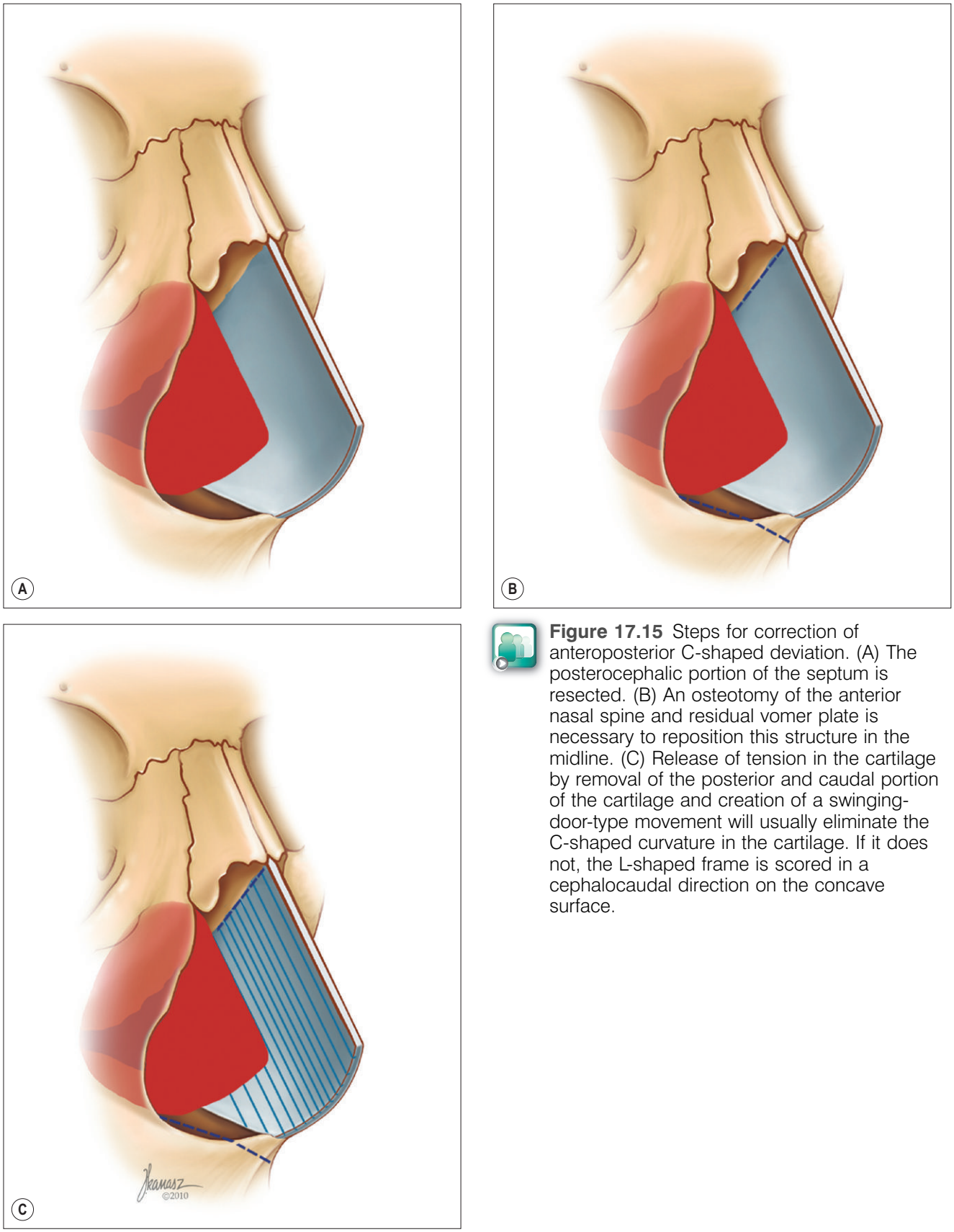


Figure 17.15 Steps for correction of anteroposterior C-shaped deviation. (A) The posterocephalic portion of the septum is resected. (B) An osteotomy of the anterior nasal spine and residual vomer plate is necessary to reposition this structure in the midline. (C) Release of tension in the cartilage by removal of the posterior and caudal portion of the cartilage and creation of a swinging-door-type movement will usually eliminate the C-shaped curvature in the cartilage. If it does not, the L-shaped frame is scored in a cephalocaudal direction on the concave surface.

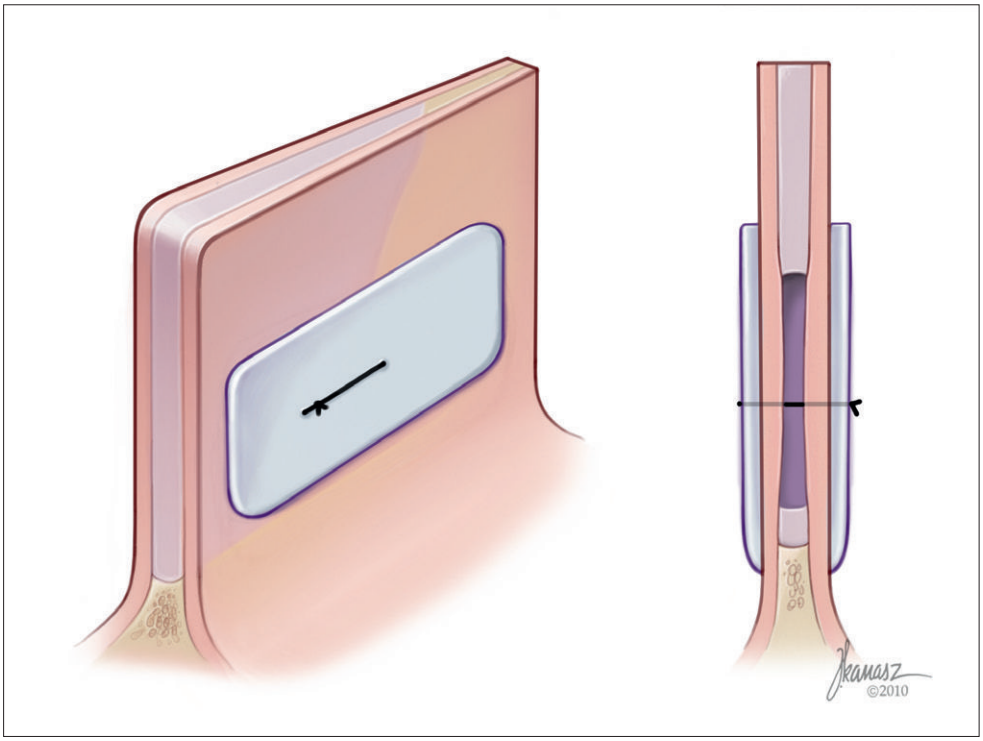


Figure 17.16 To control the effects of the scoring and eliminate the dead space, simple splints are applied on both sides and sutured in position using a 5-0 polypropylene through-and-through suture.

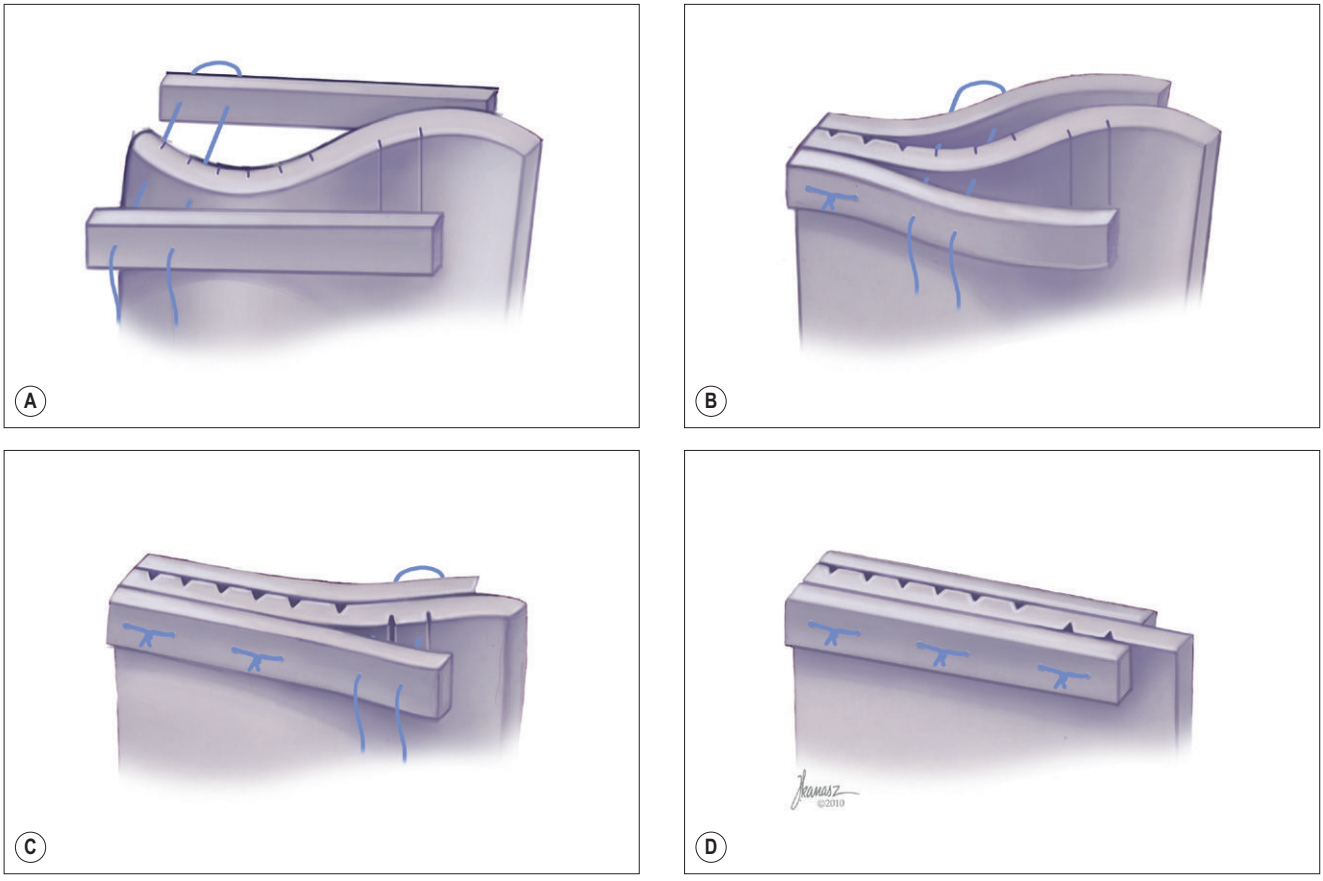


Figure 17.17 Placement of the spreader grafts to control the anterior curvature.

Figure 17.18 Before (A, C, E, G) and after (B, D, F, H) correction of C-shaped anteroposterior deviation. Illustration of the technical steps for soft tissue (I) and frame alterations (J).

BOX 17.2

Surgical Steps: Figure 17.18

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed
- A bilateral high-to-low osteotomy was carried out
- A columella strut was applied
- Transdomal sutures were placed
- A lateral crura stitch was placed
- A dorsal graft was applied
- The alar base was narrowed with sill excision on the left
- A columella onlay graft was applied

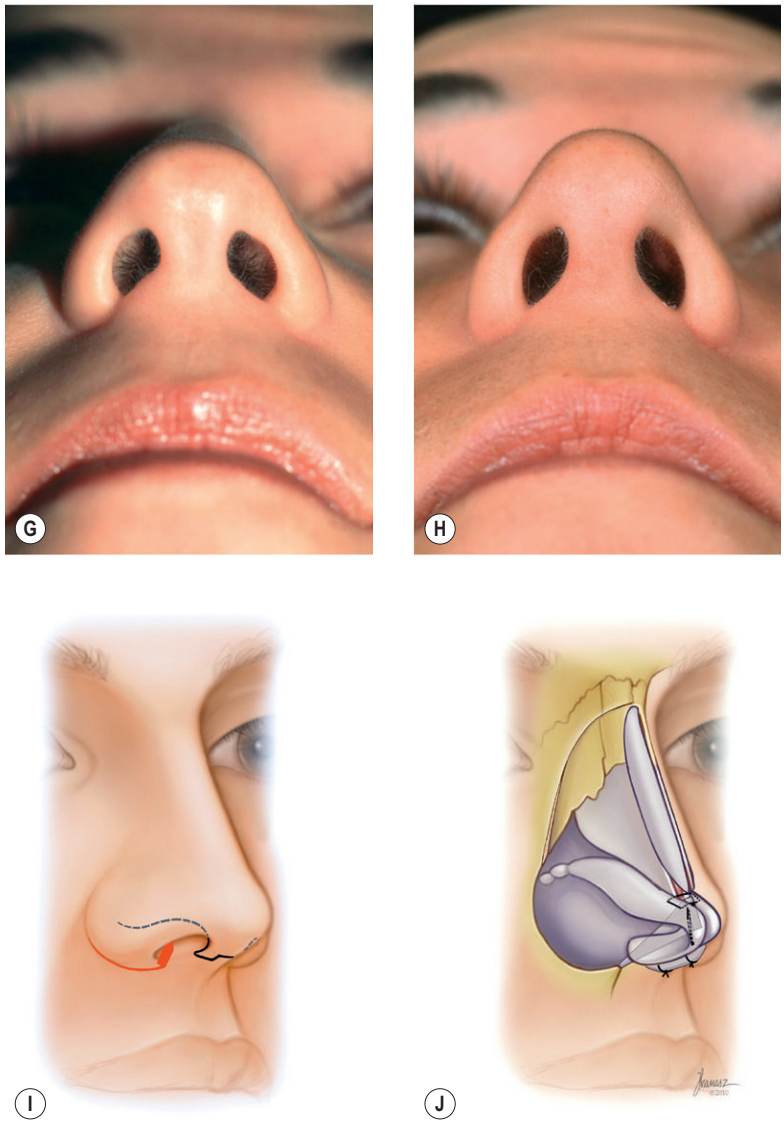


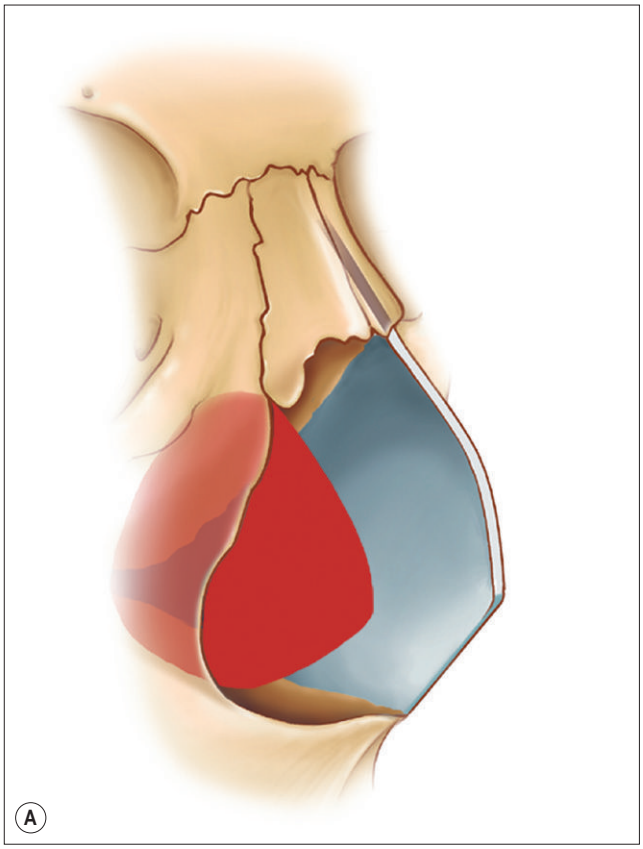
Figure 17.18, cont'd.

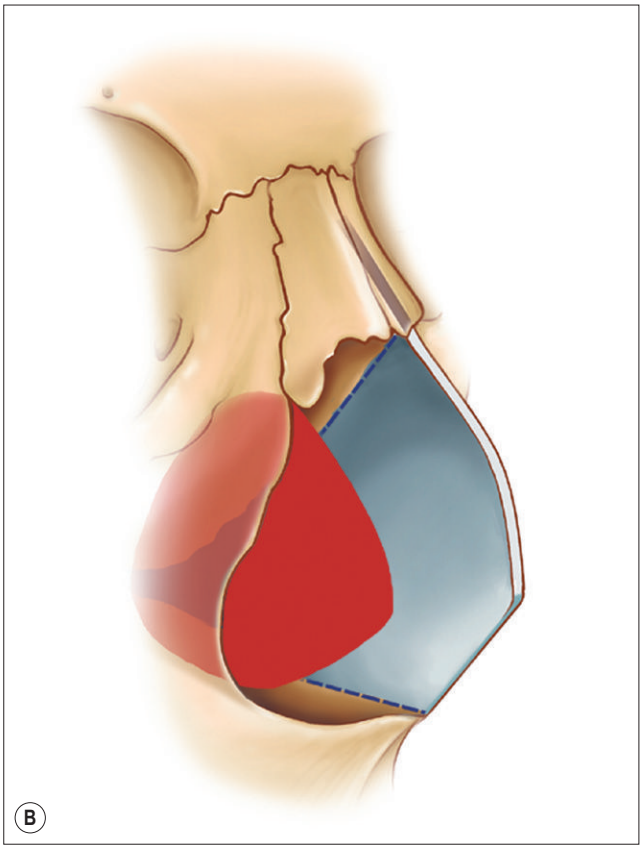
C-shaped Cephalocaudal Deviation

The surgical steps here are very similar to correction of a C-shaped anteroposterior deviation. The sole difference is in the direction of scoring, if necessary. The cartilage is scored in an anteroposterior direction on the concave side only if deemed essential (Figures 17.19, 17.20; Box 17.3; Animation 17.8; Animation 17.9).

Animation 17.8• 17.9

Often, release of tension is accomplished by resection of the posterior portion of the cartilage and removal of the redundant portion of the cartilage that is overlapping the vomer bone and the nasal spine. Extramucosal stents and spreader grafts help to keep the septum straight until adequate healing has taken place.





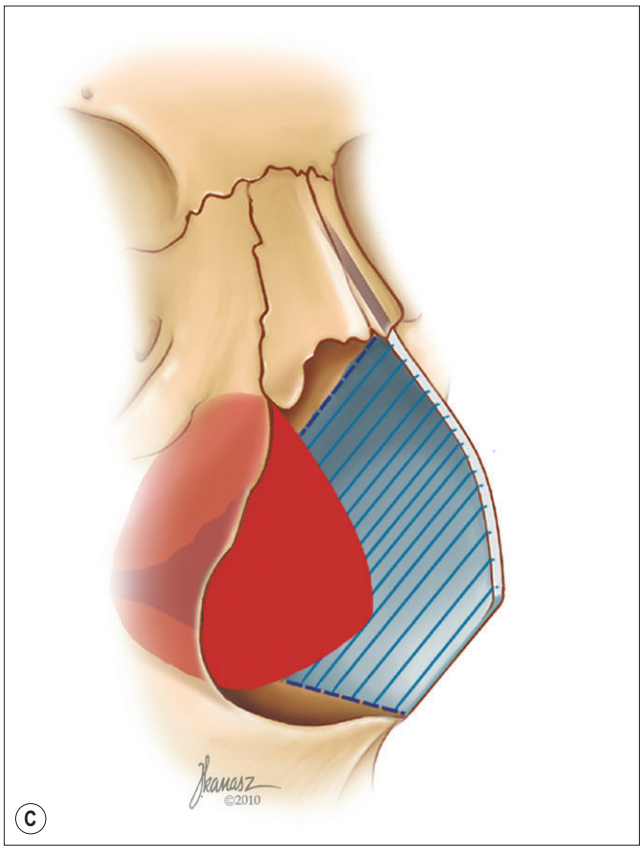


Figure 17.19 Correction of a C-shaped cephalocaudal deviation of the septum.

Figure 17.20 Before (A, C, E, G) and 18 years after (B, D, F, H) correction of a C-shaped cephalocaudal deviation. Illustration of the technical steps for soft tissue (I) and frame alterations (J).

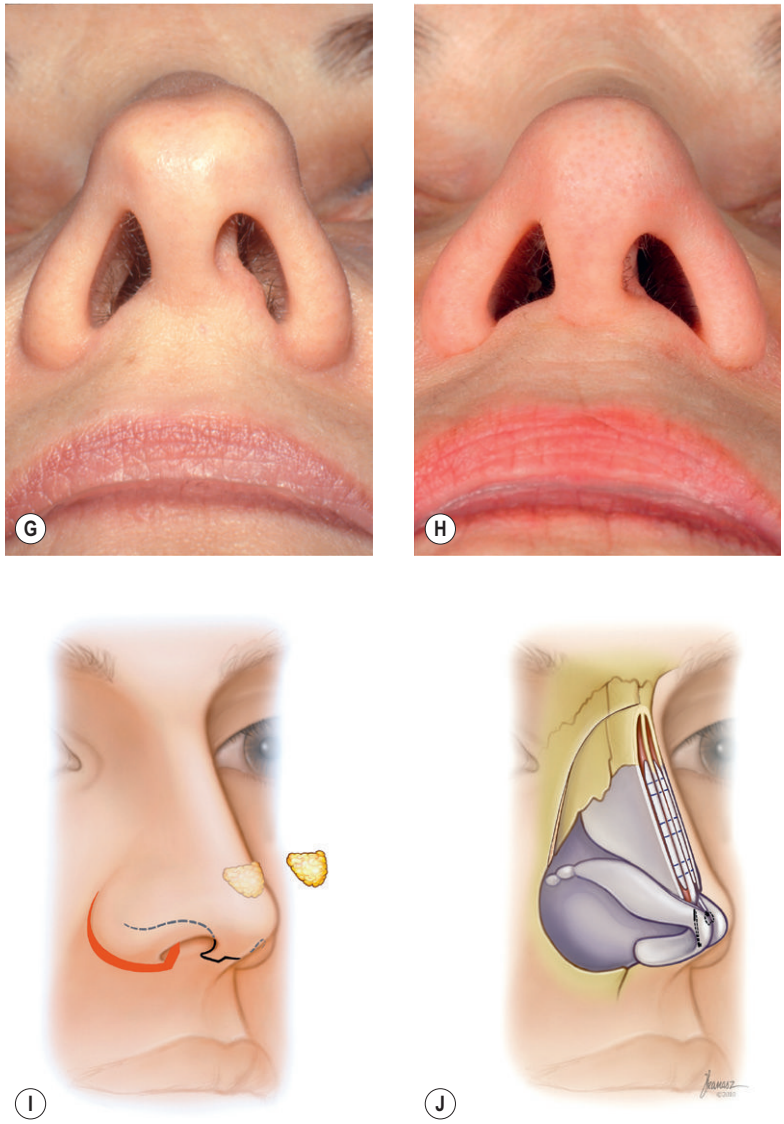


Figure 17.20, cont'd.

BOX 17.3

Surgical Steps: Figure 17.20

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty and conservative turbinectomy were performed
- A bilateral low-to-low osteotomy was carried out
- Bilateral spreader grafts were applied
- Transdomal sutures were placed
- A simple interdomal suture was placed
- Supratip soft tissue was removed
- The alar bases were narrowed with combined excision bilaterally

S-shaped Anteroposterior Deviation

This type of septal deviation is also corrected by removal of the posterior portion of the cartilage and bone, bilateral cephalocaudal scoring of the cartilage on both concave surfaces (only if necessary), and osteotomy with repositioning of the nasal spine and vomer bone when indicated (Figures 17.21, 17.22; Box 17.4; Animation 17.10; Animation 17.11).

Animation 17.10• 17.11

Commonly, during correction of this deformity, elimination of tension and application of spreader grafts to direct the memory of the cartilage is sufficient to preclude the scoring. Extramucosal stents and spreader grafts are applied if the cartilage is scored caudally.

S-shaped Cephalocaudal Deviation

Correction of this deformity is very similar to correction of an S-shaped anteroposterior deviation. The only difference is in the direction of scoring, which will be in the anteroposterior direction if scoring is deemed necessary after the other alterations to the septum are completed (Figure 17.23; Animation 17.12).

Animation 17.12•

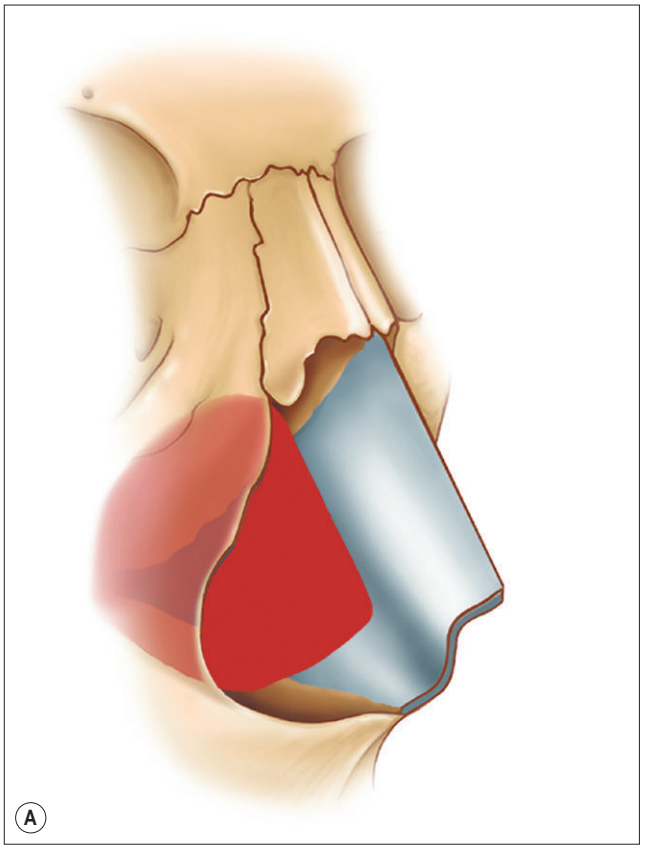
Placement of bilateral spreader grafts plays a crucial role in correcting this deformity (Figure 17.24; Box 17.5; Animation 17.13).

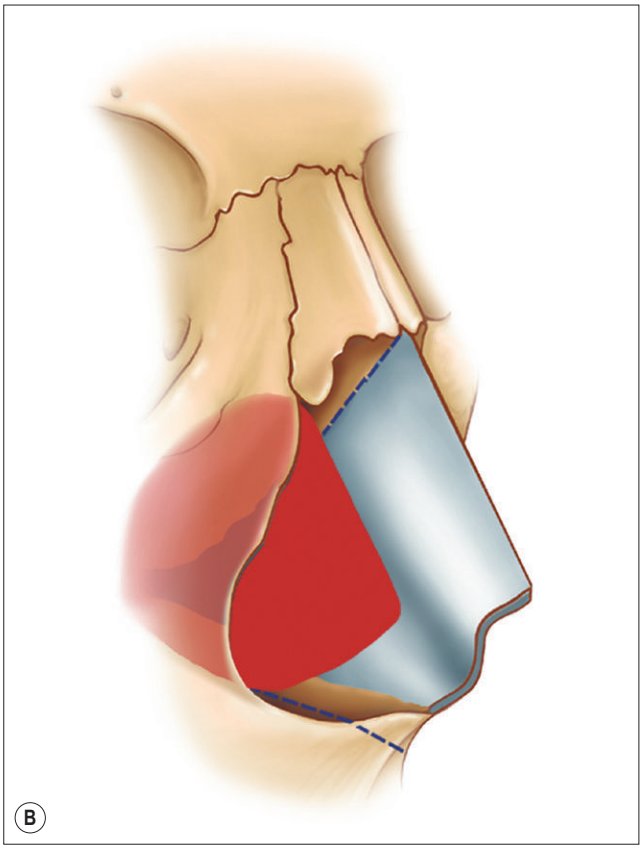
Animation 17.13•

Localized Deviation and Spurs

This type of septal abnormality is often corrected and the spurs are eliminated by posterocaudal resection of septal cartilage. The spur is often located at the junction of the vomer bone with the quadrangle cartilage and perpendicular plate of the ethmoid bone. It is safer and easier to dissect the mucoperichondrium and the periosteum on the concave side of the septum first. Otherwise, a tear in the mucoperichondrium is very likely.

If an inadvertent tear in the mucoperichondrium is unilateral, it will not become consequential. If the tear is bilateral but the perforations are not apposing, the mucosa may still heal without a persistent perforation. To ensure avoidance of a persistent perforation with this scenario and when there are bilateral apposing tears in the mucoperichondrium, a straight piece of septal cartilage, a piece of the perpendicular plate of the ethmoid bone, or a PDS plate is placed between the mucoperichondrial flaps, spanning the full width of the perforation site, as discussed in Chapter 19.





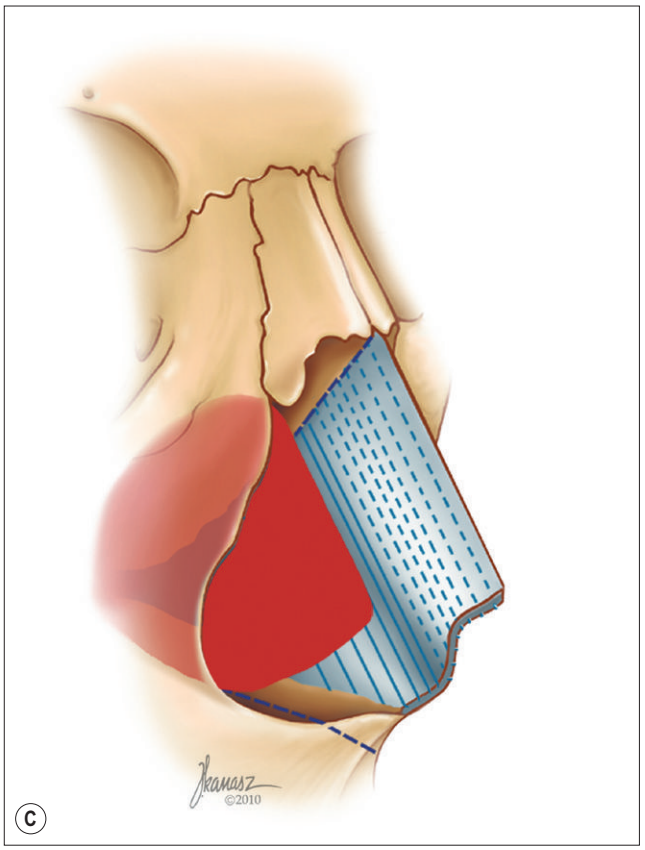


Figure 17.21 Correction of an S-shaped anteroposterior deviation.

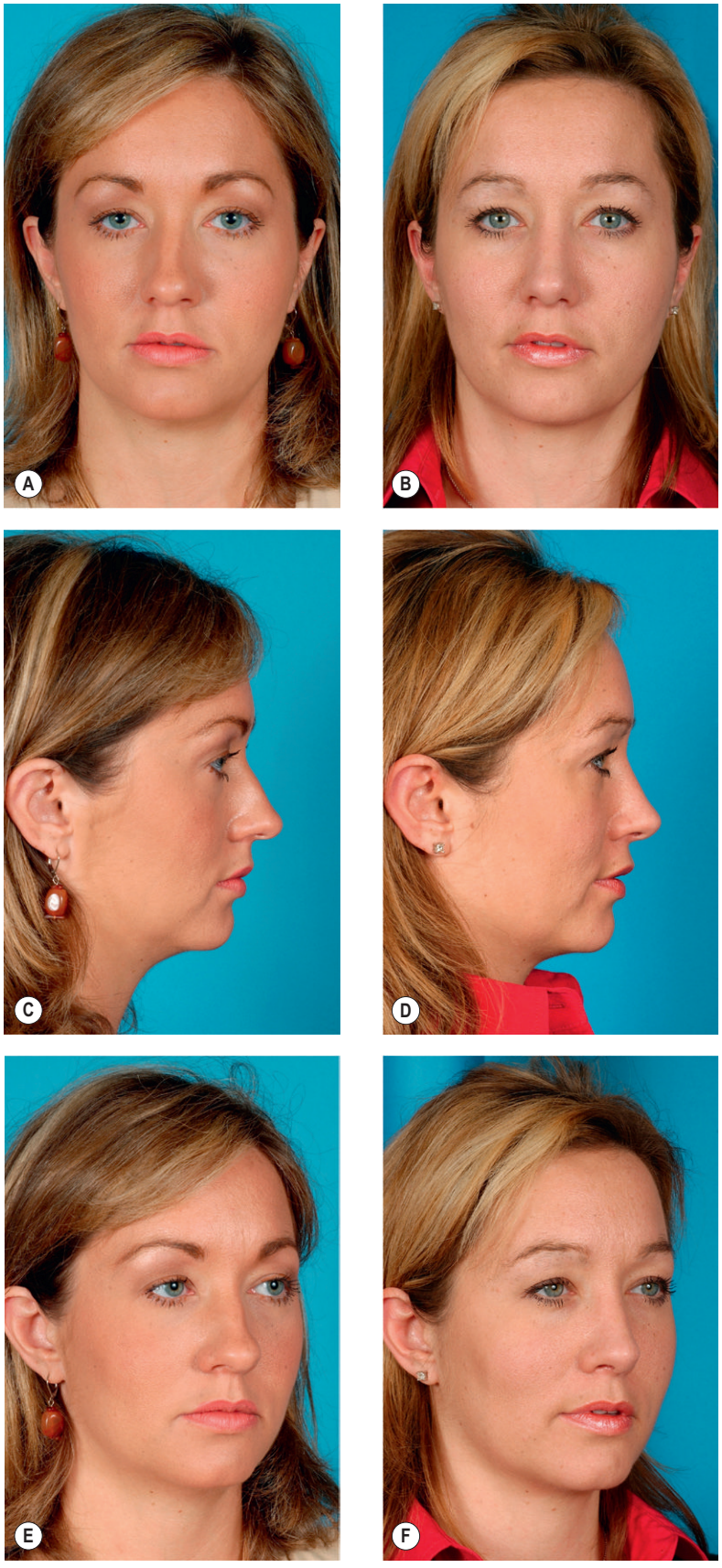
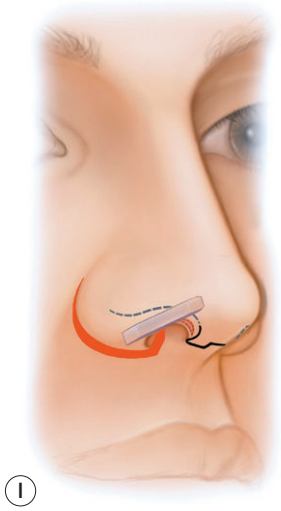
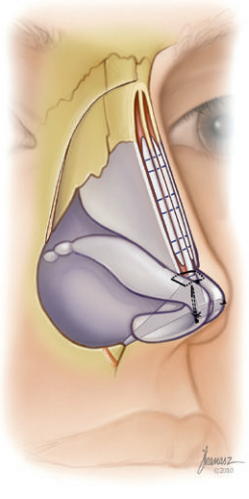


Figure 17.22 Before (A, C, E, G) and 39 months after (B, D, F, H) correction of an S shaped anteroposterior deviation of the septum. Illustration of the technical steps for soft tissue (I) and frame alterations (J).

Figure 17.22, cont'd.

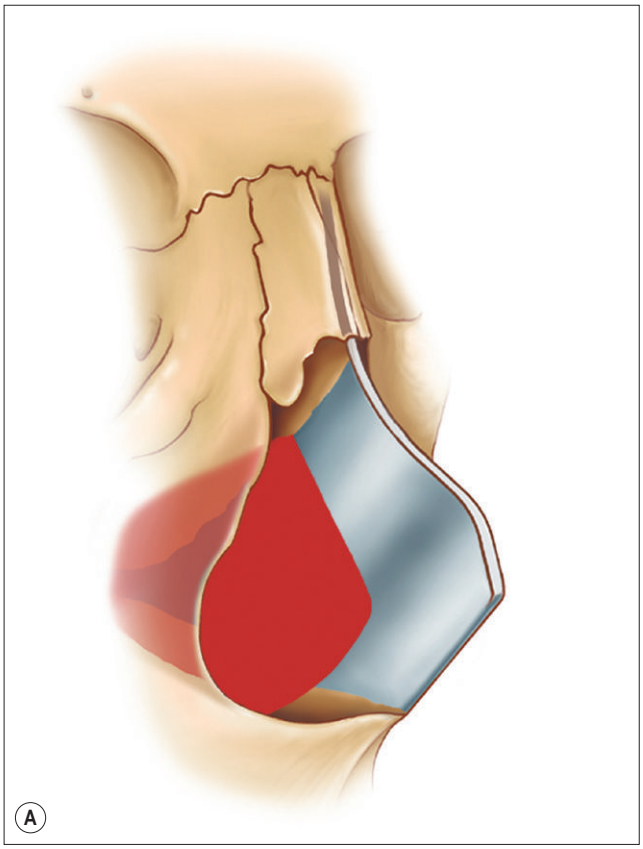


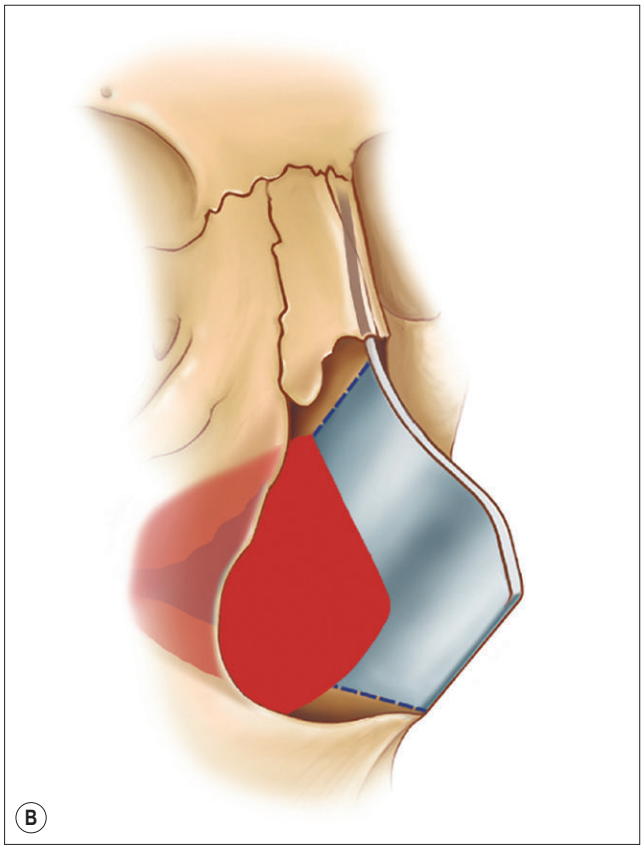


BOX 17.4

Surgical Steps: Figure 17.22

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was carried out
- A bilateral low-to-low osteotomy was carried out
- Bilateral spreader grafts were applied
- A columella strut was applied
- Transdomal sutures were placed
- A lateral crura stitch was placed
- A subdomal graft was applied
- Nasal spine osteotomy was performed with repositioning in the midline
- The alar bases were narrowed with combined excision bilaterally
- Alar rim grafts were applied bilaterally
- The soft triangle lining was removed bilaterally
- The upper lateral cartilages were approximated to the septum





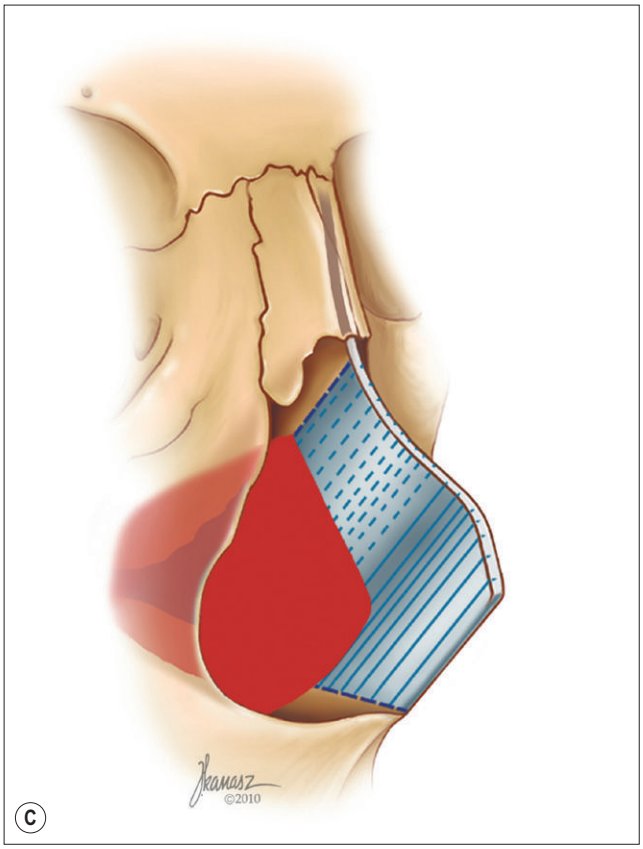
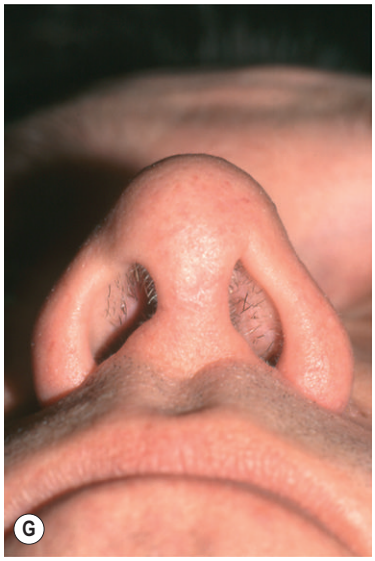
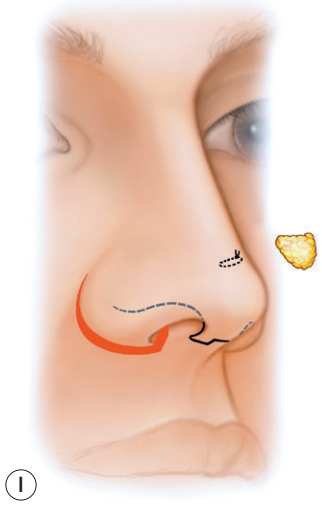


Figure 17.23 Correction of an S-shaped cephalocaudal deviation.

Figure 17.24 Before (A, C, E, G) and 13 years after (B, D, F, H) correction of an S-shaped cephalocaudal deviation. Illustration of the technical steps for soft tissue (I) and frame alterations (J).





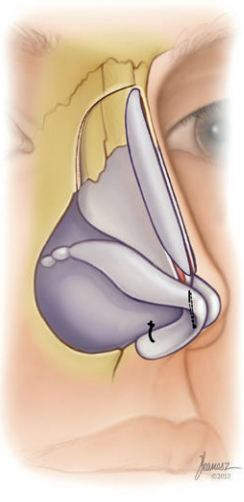


Figure 17.24, cont'd.

BOX 17.5

Surgical Steps: Figure 17.24

- An open technique was used
- A bilateral high-to-low osteotomy was carried out
- The cephalic margin of the lower lateral cartilages was trimmed and dorsal irregularity was eliminated
- A septoplasty was performed
- Spreader grafts were applied
- Transdomal sutures were placed
- A dorsal graft was applied
- Supratip soft tissue was removed
- The footplates were approximated
- A supratip stitch was placed to eliminate the dead space cephalad to the domes
- The alar bases were narrowed with combined excision bilaterally

Use of Stents

After completion of the septal surgery, a Doyle stent or a Simple Stent is placed on either side of the septum and fixed in position using a through-and-through 4-0 polypropylene suture. The patient is kept on systemic antibiotics throughout the period that the stents are in position, which is usually 4 days without perforation and 2–3 weeks when a through-and-through perforation is encountered.

Correction of Deviated Caudal Dorsum

In spite of a thorough septoplasty, the caudal portion of the dorsal L-shaped strut may remain deviated to one side along the caudal third of the anterior septum. This is a fairly common finding. It can be readily corrected with a septal rotation suture.[10] After the spreader grafts are sutured in position, a 5-0 PDS suture is passed through the caudal portion of upper lateral cartilage further cephalically on the side towards which the septum needs to be shifted (Figure 17.25A; Animation 17.14). The suture is then passed through the spreader grafts and the septum (Figure 17.25B; see Video 4.20a in Chapter 4). The suture is next passed through the opposite upper lateral cartilage relatively caudally on the side towards which the septum is currently deviated, and brought back to the side from where the suture was initially started and tied (Figure 17.25C, D). As the suture is tied, since the upper lateral cartilage is somewhat fixed, the composite layers including the spreader grafts and the septum will be pulled to the side where the suture has been placed more cephalically. The suture is tied incrementally until the septum becomes perfectly aligned with a line bisecting the intercanthal line and the upper incisor midline, as long as these structures are positioned centrally (Figure 17.25E). A second suture may be required to avoid bowing of the upper lateral cartilage on the side towards which the septum is being rotated (Figures 17.25F, 17.26; Box 17.6; Animation 17.15).

Animation 17.14• 17.15

Correction of Deviated Nasal Base

A deviated caudal nose is almost invariably associated with structural asymmetry in the lower lateral cartilages. This often means that either one lower lateral cartilage is shorter than optimal or the other lower lateral cartilage is longer than necessary. Successful correction requires elongation of the short side or shortening of the long side.

If the goal is reduction of the projection of the lower lateral cartilage on one side, the cartilage is exposed and transected and overlapped laterally, medially, or both depending on the orientation of the lower lateral cartilage and taking into consideration the tripod concept (Figure 17.27; Animation 17.16). This will be completed with the support of a columella strut. The domes are aligned at the midline and the segments are sutured to avoid shifting with time. If the caudal septum is displaced, it should be straightened first before adjusting the length of the lower lateral cartilage.

Animation 17.16•

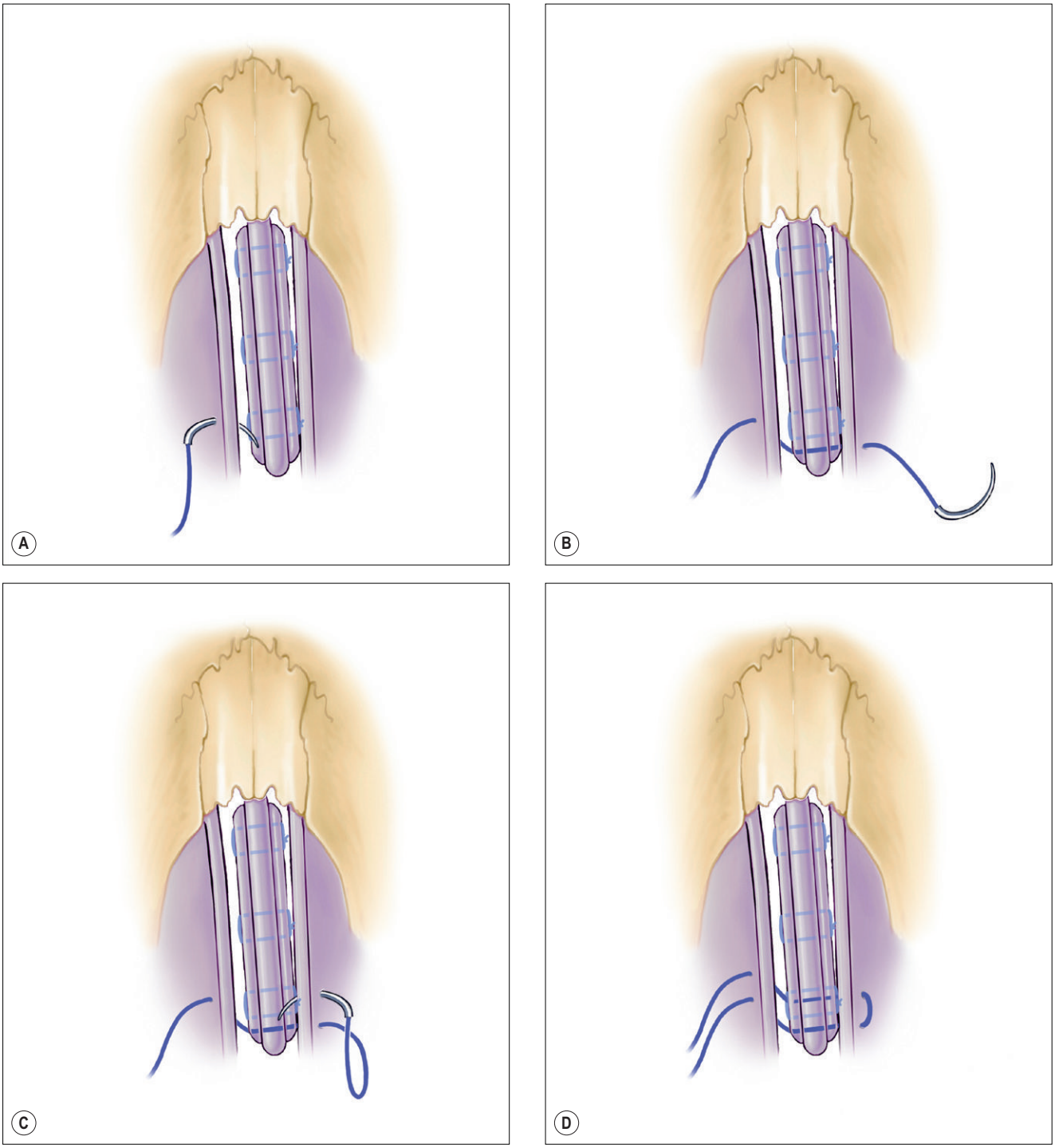
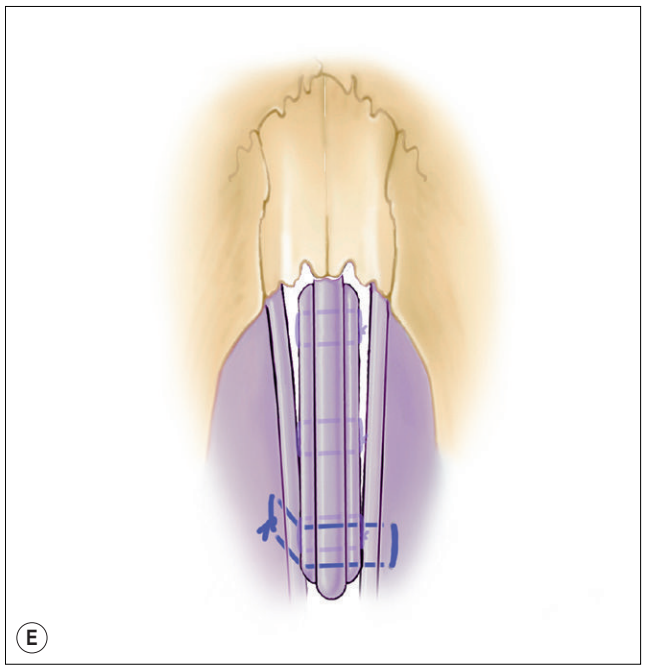


Figure 17.25 Steps involved in the placement of a septal rotation suture. (A) Once the spreader grafts are sutured in position, a 5-0 PDS suture is passed through the caudal portion of upper lateral cartilage further cephalically on the side towards which the septum needs to be shifted. (B) The suture is then passed through the spreader grafts and the septum. (C) The suture is next passed through the opposite upper lateral cartilage relatively caudally on the side towards which the septum is currently deviated and (D) brought back to the side from where the suture was initially started and tied. (E) The suture is tied incrementally until the septum becomes perfectly aligned with a line bisecting the intercanthal line and the upper incisor midline, as long as these structures are positioned centrally. (F) A second suture may be required to avoid bowing of the upper lateral cartilage on the side towards which the septum is being rotated.



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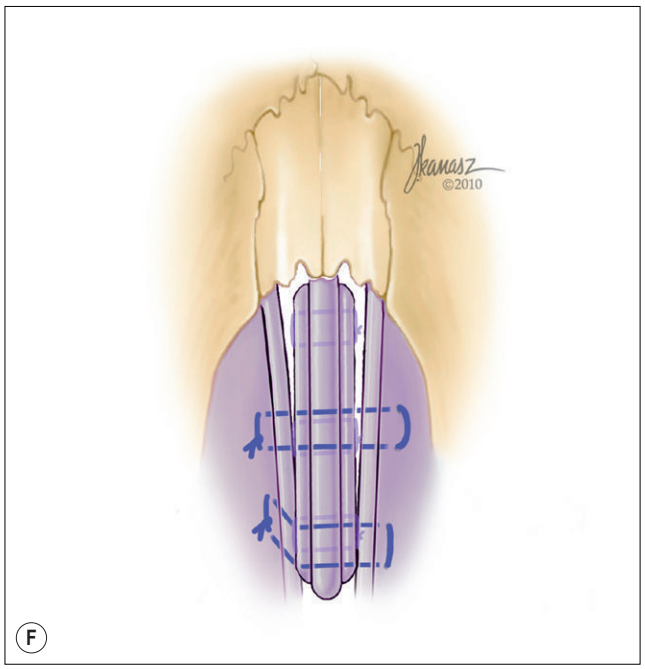
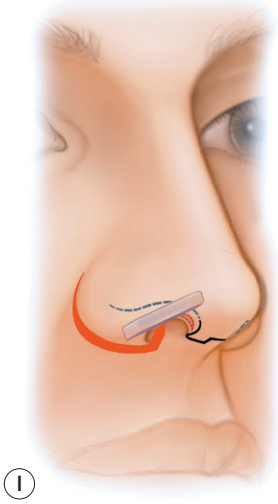


F

Figure 17.25, cont'd.

Figure 17.26 Before (A, C, E, G) and 1 year after correction of caudal deviation of the nose (B, D, F, H). Illustration of the technical steps for soft tissue (I) and frame alterations (J).



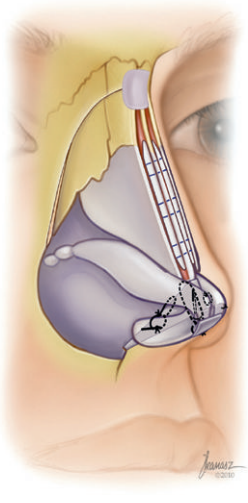


Figure 17.26, cont'd.

BOX 17.6

Surgical Steps: Figure 17.26

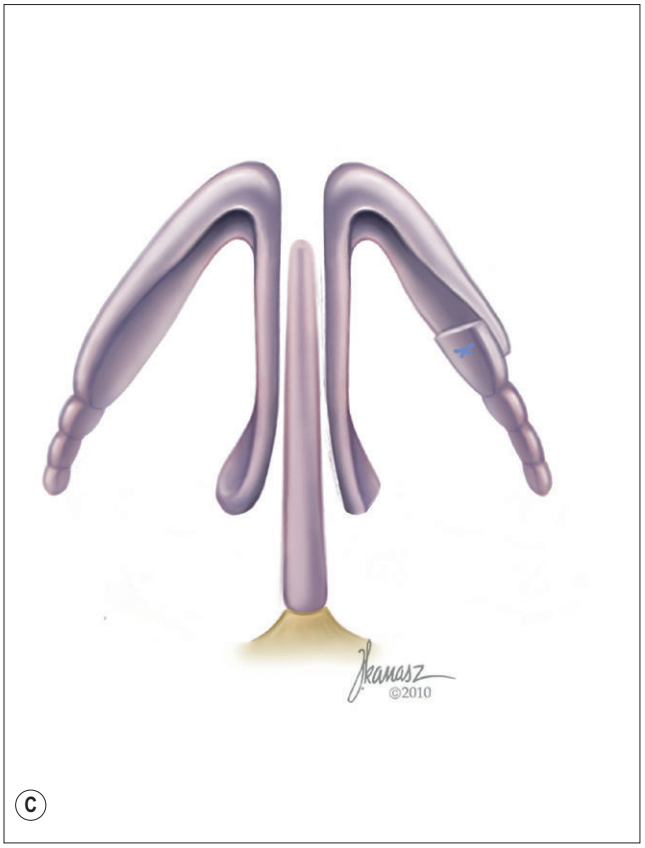
- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was carried out
- A bilateral low-to-low osteotomy was carried out
- Medial osteotomies were performed bilaterally
- Anteroposterior percutaneous osteotomy was performed cephalically
- Lateral osteotomies were performed bilaterally
- Bilateral spreader grafts were applied
- A septal rotation suture was placed
- A columella strut was applied
- Transdomal sutures were placed
- A simple interdomal suture was placed
- A subdomal graft was applied
- The caudal septum was resected in a rectangular shape allowing for retraction of the columella
- The footplates were resected and approximated
- The nasion was augmented
- The alar bases were narrowed with combined excision bilaterally
- Bilateral alar rim grafts were applied
- A lateral crural onlay graft was applied on the right
- The footplates were anchored to the caudal septum
- A tip rotation suture was placed
- A lobule graft was applied
- The soft triangle lining was removed bilaterally
- The depressor nasi septi muscle was removed
- The digastric septi nasi labialis muscle was removed

If the goal is to elongate the lower lateral cartilage, the cartilage is mobilized completely, advanced anteriorly, and fixed in position with the support of a columella and lateral crus strut, with or without the interruption of the lateral and medial crura (Figure 17.28; Animation 17.17). Again, the segments are fixed in position securely, which will successfully reposition the deviated nasal base (Figure 17.29; Box 17.7; Animation 17.18).

Animation 17.17 • 17.18

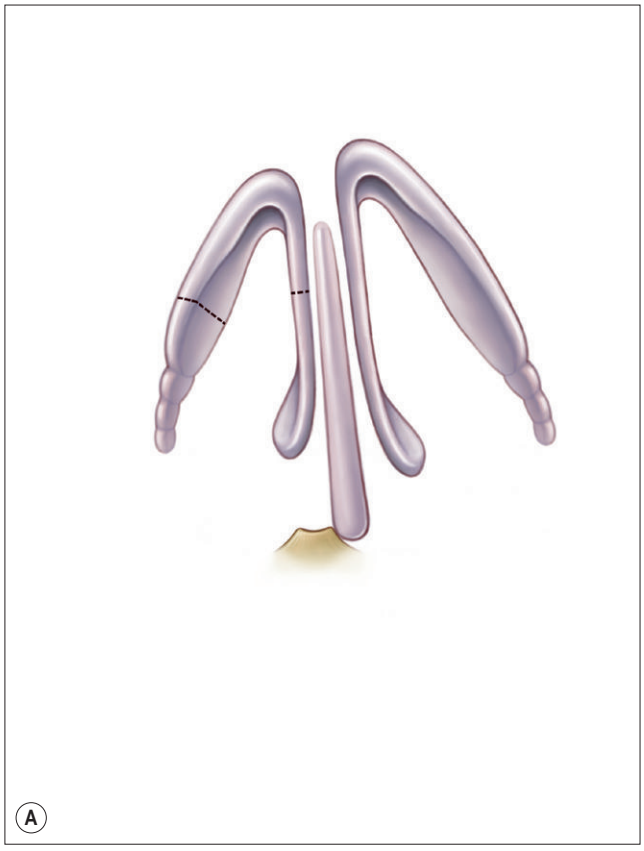
A

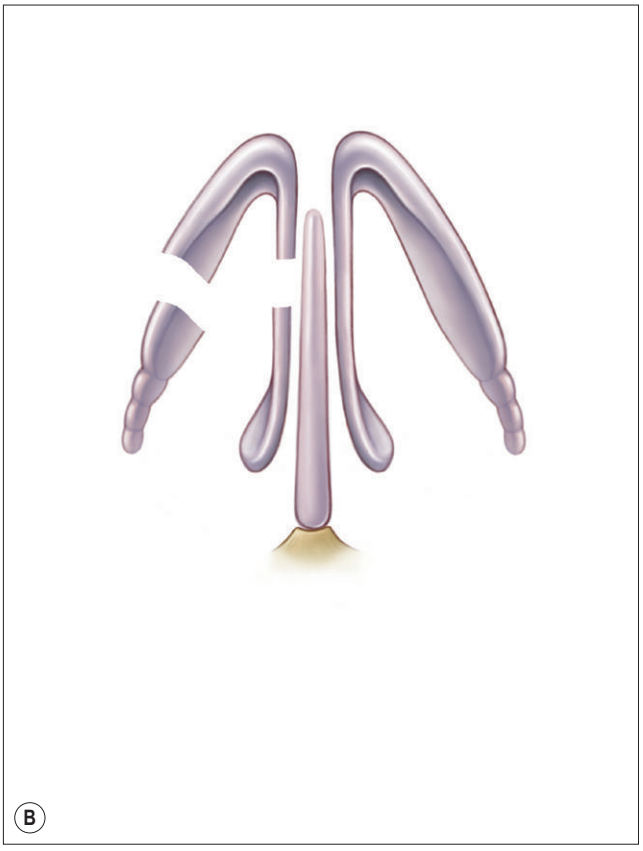
B



C

Figure 17.27 If the goal is reduction of the projection of the lower lateral cartilage on one side, the cartilage is exposed and transected and overlapped laterally, medially, or both depending on the orientation of the lower lateral cartilage and taking into consideration the tripod concept (A, B, C).





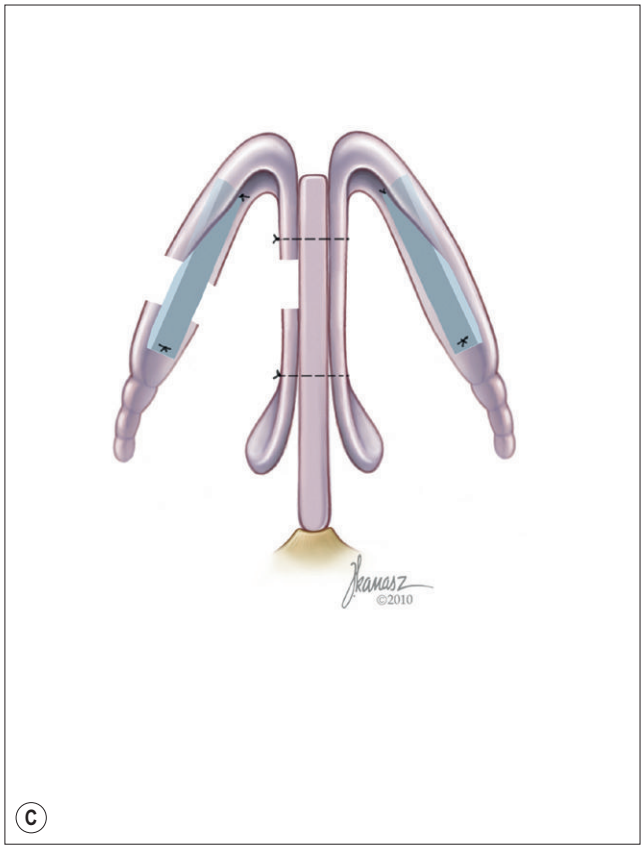


Figure 17.28 The lower lateral cartilage is mobilized completely, advanced anteriorly, and fixed in position with the support of a columella and lateral crus strut. The segments are fixed in position securely, which will successfully reposition the deviated nasal base.

The Role of Turbinates

Almost invariably, whenever there is a deviation of the septum to one side, the apposing inferior and commonly the middle turbinate becomes large. Repositioning the septum without reducing the size of the turbinate is ill-advised and may not be practical. Some rhinoplasty authorities have stated that if the septal deviation is corrected the turbinate will shrink. This belief is illogical, since the septum cannot be repositioned while the turbinate is still large as it prevents repositioning of the septum intraoperatively. Even if the septum could be forced into position, it will be displaced in time, especially since there is often no longer any bone or septal cartilage at this level to compress the enlarged turbinate. Additionally, there is no good reason for leaving intact a turbinate that is larger than optimal and hoping that it will become smaller. The inferior (see Chapter 4) and middle turbinates are reduced conservatively, leaving normal-sized turbinates in place. However, maintaining a stable, reduced middle turbinate could be challenging following partial middle turbinectomy and it may be necessary to remove the entire middle turbinate in symptomatic patients with migraine or sinus headaches.

Turbinectomy

A complete inferior turbinectomy has no role in the management of septo-nasal deviation because of the potential for dryness of the nose and the important physiological role of the turbinate. If the inferior turbinate is removed too zealously, the excessively patent nasal airway can lead to pharyngeal dryness, increased sensitivity to cold air, ozena, and a paradoxical sensation of nasal obstruction.[15] Therefore, turbinectomy should always be carried out conservatively.

Submucous turbinate resection has been advocated by many. However, this does not eliminate the hypertrophic soft tissues. Partial turbinectomy is the most versatile and predictable option as it addresses both the hypertrophic mucosa and the underlying bone while leaving a normal-sized turbinate behind. It also leads to less morbidity and greater success than complete turbinectomy. Partial turbinectomy should be carried out evenly across the full length of the turbinate in most cases, rather than performing only an anterior or posterior turbinectomy, as advocated by a few. Otherwise, the retained portion of the turbinate undergoes compensatory hypertrophy and requires additional surgery. The only exception to this rule is the patient who has already undergone anterior or posterior reduction of the turbinates that has resulted in compensatory enlargement of the remaining portion. In this scenario, only the enlarged portion is trimmed and the raw surface is gently cauterized to reduce postoperative bleeding. The middle turbinate can be out-fractured, or partially or completely removed, if indicated. The concha bullosa can be treated by removal of the medial wall or, on rare occasions, the entire turbinate.

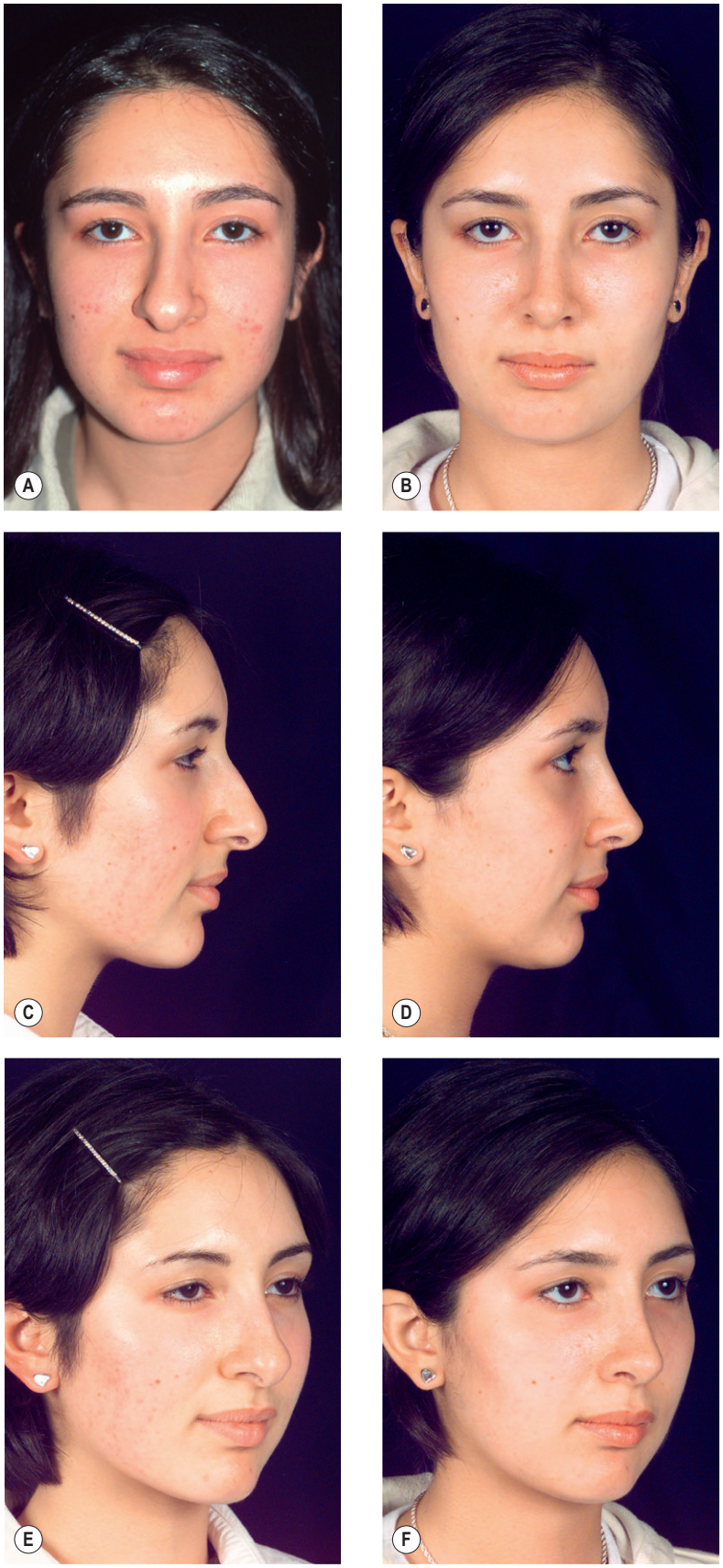
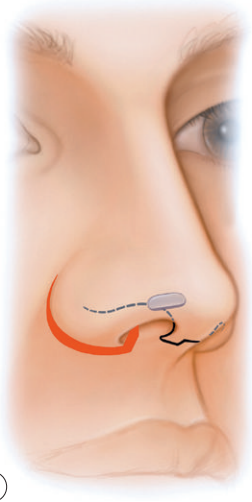


Figure 17.29 A patient before (A, C, E, G) and 1 month after correction of tip deviation (B, D, F, H) with adjustment of the lower lateral projection. Illustration of the technical steps for soft tissue (I) and frame alterations (J).



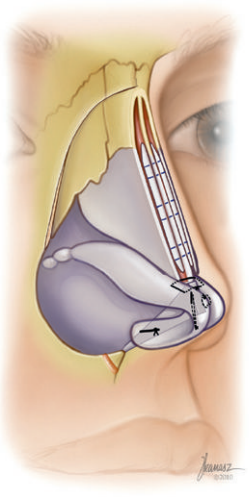


Figure 17.29, cont'd.

BOX 17.7

Surgical Steps: Figure 17.29

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was carried out
- A bilateral low-to-low osteotomy was carried out
- Bilateral spreader grafts were applied
- A columella strut was applied
- Transdomal sutures were placed
- A figure-of-eight interdomal suture was placed
- A lateral crura stitch was placed
- The caudal septum was resected in a rectangular shape allowing for retraction of the columella
- Nasal spine osteotomy was performed and the nasal spine was repositioned in the midline
- The footplates were resected
- The alar bases were narrowed with combined excision bilaterally
- A soft triangle graft was applied

Postoperative Care

A dorsal splint is applied if an osteotomy is part of the procedure. Otherwise, SteriStrips™ will suffice. Doyle stents are also placed on either side of the septum and fixed in position using 4-0 polypropylene sutures. Use of Doyle stents allows further stabilization of the septum and elimination of the dead space. The external splint is left on for 8 days while the internal Doyle stent is removed in 3–8 days, depending on the condition. The extramucosal internal stents (Simple Stents™) that are placed after septal scoring are maintained for 2–3 weeks. The patient is kept on antibiotics while the Doyle internal splints are in place. If a nasal bone osteotomy is part of the surgical plan, a Medrol dose-pack is also prescribed to minimize swelling and bruising. However, corticosteroids are avoided in patients with active acne and patients with a propensity for severe acne. Heavy physical activity is curtailed for 3 weeks. The patient is instructed to avoid wearing any kind of glasses for 5 weeks after nasal bone osteotomy.

Secondary Procedures

Although the prevailing goal is a single surgery, secondary procedures may become necessary to achieve optimal results, even for the most skilled surgeon with the best intentions. It is important to discuss this possibility with patients who undergo rhinoplasty for any reason, especially those with a deviated nose.

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CHAPTER 18

Rhinoplasty and Ethnicity

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Pearls

- The African-American face has distinct characteristics such as prominent forehead, prominent malar bones, wider bi-malar distance, prominent lips, and, often, microgenia that have to be taken into consideration in planning the rhinoplasty.
- The African-American nose is often wide, flat with short nasal bones, has an underprojected wide tip, wide alar bases, thin lower lateral cartilages, a low radix, small hump, and deficient subnasale.

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- Since the nasal bones are short in African-American noses, they may not heal consistently in the optimal position and may shift laterally as time elapses.
- Narrowing of the alar base in African-American noses may require removal of skin from the nostril sill area, even if the sill is ill-defined or absent.
- Asian patients have a receding mid-face, prominent lips, prominent and wide malar bones, and microgenia.
- Asian noses have wide nasal bones, wide and thin lower lateral cartilages, a wide tip, a wide base, low radix, minimal or no hump, inadequate tip projection, deficient subnasale, short and wide horizontally oriented nostrils, and footplates that are displaced laterally.
- Available septal cartilage on both Asian and African-American noses is limited and one has to be prepared to harvest conchal or costal cartilage graft, especially for secondary rhinoplasty.
- The specific maneuvers required for correction of the Asian nose include a more common need for dorsal augmentation, tip graft, use of a columella strut, elongation of the nose, reorientation of the nostril, and removal of the redundant portion of the soft triangle lining.
- Many Middle Eastern patients have some degree of dorsal deviation which often becomes more obvious after removal of the dorsal hump.
- The intercanthal distance in Middle Eastern noses is usually narrower and augmentation of the radix, if necessary, should be done conservatively.
- Middle Eastern patients commonly have long nasal bones, a narrow vault, long upper lateral cartilages, hanging tip, base asymmetry, low radix, large hump, inadequate tip projection, hanging columella, and deficient anterior nasal spine.
- Since the tip is very dependent on the dorsum on patients of Middle Eastern descent, as the hump is reduced, the tip projection will be significantly diminished.
- One key step in achieving sufficient improvement and an optimal and lasting outcome on Middle Eastern noses is cephalic rotation of the tip and fixation in new position using a non-absorbable suture.
- Additionally, correction of Middle Eastern noses will require spreader grafts, columella strut and weakening of the depressor nasi septi muscle.

Facial ethnicity is defined by the color of the skin, along with the length, width, and projection of the different segments of the face. Regardless of ethnicity, the attractiveness of the face is governed by the harmony between the different zones.[1,2] This includes the nose. Additionally, there has to be an

equilibrium between the different units of the nose in order for it to look pleasing. In this chapter, we will focus on three common ethnic noses and describe the physical attributes and the changes that would create a better balance between the nose and the rest of the face for each ethnic group.

African-American Nose

Analysis

Compared to Caucasians, most African-American patients have a broader face, thicker and darker skin, and a flatter and wider central face. Commonly, the malar bones are more prominent and often the forehead protrudes more, creating a greater difference in level between the radix and the glabella area (a deeper radix). The lips are more prominent, making judgments about the nasolabial angle difficult. The chin is commonly short and receding (horizontal and vertical microgenia).

On a frontal view of the nose, one often finds a wide nose with short nasal bones, wide lower lateral cartilages, a wide tip, thin and often convex lower lateral cartilages, and a wide alar base, often without a well-defined nostril sill (Box 18.1; Figure 18.1).

In the profile view, the radix is positioned caudally (low) and is deep. A hump is rarely present and, if it exists, it is very small. Tip projection is often inadequate and the subnasale is deficient. The prominence of the lips, microgenia and inadequate mid-face projection, features that make planning the rhinoplasty more perplexing, are more noticeable in the profile view. The nasolabial angle is often too narrow. (Box 18.2; Figure 18.2).

On the basilar view, the nostrils are short and often horizontally oriented, the columella is short, the tip is broad, the alar bases are too wide and the footplates are seldom displayed (Box 18.3; Figure 18.3). On intranasal examination, African-Americans have a limited amount of septal cartilage. Thus, many African-American patients undergoing secondary rhinoplasty should be prepared for harvesting conchal or costal cartilage graft. The septum is less commonly deviated, especially compared to patients from the Middle East.

Surgical Correction

The specifics of surgical correction vary from patient to patient but often include many augmentation techniques. Since the nasal bones are short, they may not heal consistently in the required position. Specifically, as time elapses, they shift laterally despite being adequately narrowed intraoperatively. Augmentation of the premaxilla is advisable in many such patients. However, this commonly results in widening of the nostrils and renders alar base narrowing

Figure 18.1 Front view of an African-American patient depicting many of the characteristic features outlined in Box 18.1.

Figure 18.2 The profile view of the African-American nose.

BOX 18.1

Features of the African-American Nose on Frontal View

- Wide nose
- Short nasal bones
- Wide lower lateral cartilages
- Wide tip
- Thin, convex lower lateral cartilages
- Wide base
- Protruding lips
- Short chin

BOX 18.2

Features of the African-American Nose on Profile View

- Low, deep radix
- No or small hump
- Inadequate tip projection
- Deficient subnasale
- Prominent lips
- Microgenia
- Convex midface

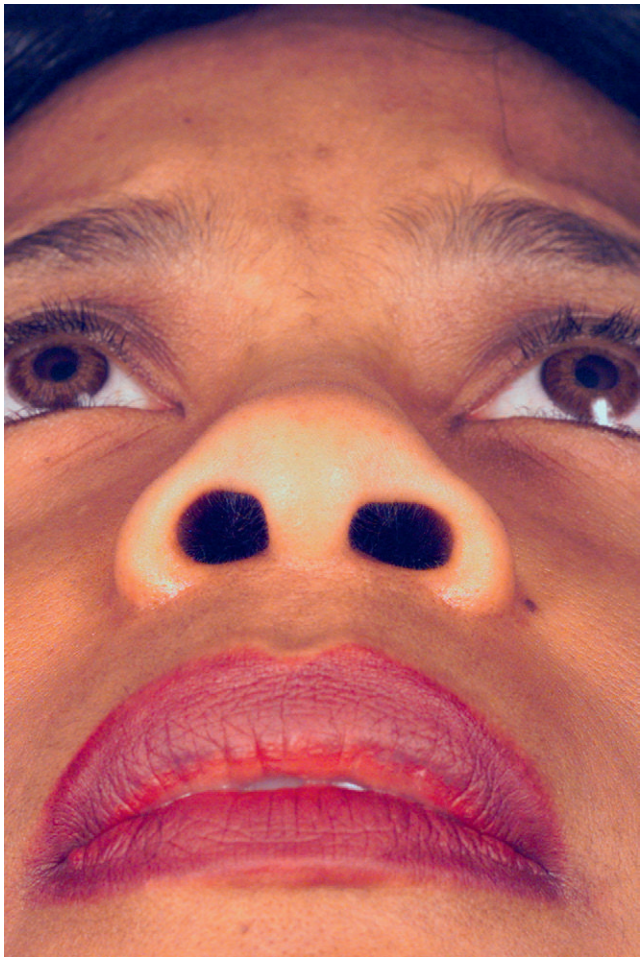


Figure 18.3 The basilar view of the African-American nose.

BOX 18.3

Features of the African-American Nose on Basilar View

- Wide domes
- Short columella
- Horizontal nostrils
- Wide alar base (sill)
- Wide columella
- Displayed footplates

more arduous. Because of the thinness of the lower lateral cartilages, creation of tip definition often requires the application of both a columella strut and a tip graft. Use of spreader grafts on these patients is seldom necessary because they do not commonly have a large hump and it is often not necessary to violate the integrity of the nasal vault. The combination of thick skin and thin cartilage creates a taxing blend for achievement of proper tip definition. This goal can be achieved with a combination of a columella strut and a tip graft. Chin elongation and advancement can be beneficial to many African-American patients. Narrowing of the alar base may require removal of skin from the nostril sill area, even if the sill is ill-defined or absent, to allow advancement of the lateral alar base flap medially. Lateral excision alone is not usually sufficient.

Animation 18.1 •

Some of the deficiency in the subnasale improves with a columella strut. Placement of an alar rim graft or lateral crura strut may produce a better outcome in these patients (Figure 18.4; Box 18.4; Animation 18.1). Many have a redundant soft triangle lining, removal of which helps to improve the displeasing orientation of the nostrils. A hanging ala is more common in African-American patients and can be corrected using the technique described in Chapter 11.

Asian Nose

Analysis

Asian patients, in general, have wider noses with a midface that is less projected than that of Caucasians. The lips are often prominent and the chin is commonly receding. Asian patients often have very prominent malar bones and the bigonial distance is wider, accompanied by a prominent mandibular angle.

On assessment of the front view (Box 18.5; Figure 18.5), one notes a wide and flat nose, and the nasal bones are often short and wide. Asian noses have wide lower lateral cartilages, a wide tip, thin and convex lower lateral cartilages, and a wide alar base.

Figure 18.4 Standard rhinoplasty views of an African-American patient before (A, C, E, G) and 36 months after rhinoplasty (B, D, F, H). Illustration of the technical steps for soft tissue (I) and frame alterations (J).

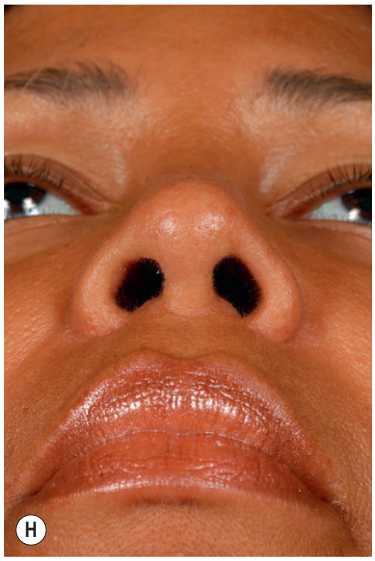
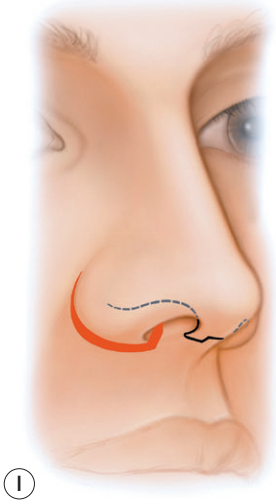
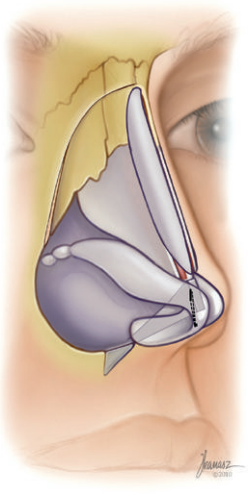


Figure 18.4, cont'd.





BOX 18.4

Surgical Steps: Figure 18.4

- An open technique was used
- A septoplasty was performed using an open technique
- A bilateral low-to-low osteotomy was carried out
- A columella strut was applied
- Transdomal sutures were placed
- A nasal spine graft was applied
- A dorsal graft was applied
- The alar bases were narrowed with combined excision bilaterally

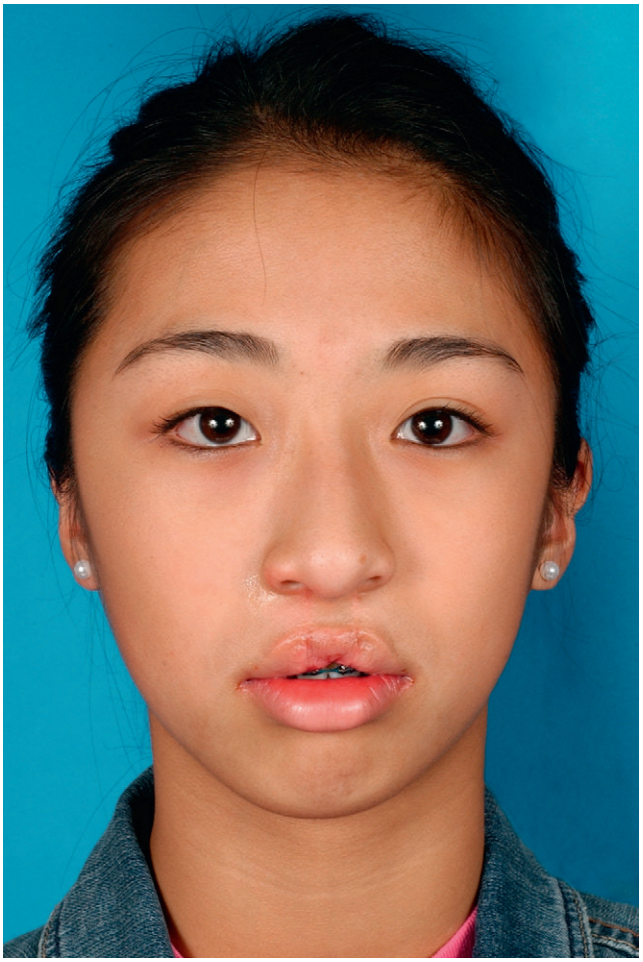


Figure 18.5 Front view of a patient of Asian descent who had a bilateral cleft lip nose deformity repaired in infancy, depicting the features listed in Box 18.5.

BOX 18.5

Features of the Asian Nose on Frontal View

- Wide nose
- Variable nasal bones
- Wide lower lateral cartilages
- Wide tip
- Thin, convex lower lateral cartilages
- Wide base
- Protruding lips
- Short chin

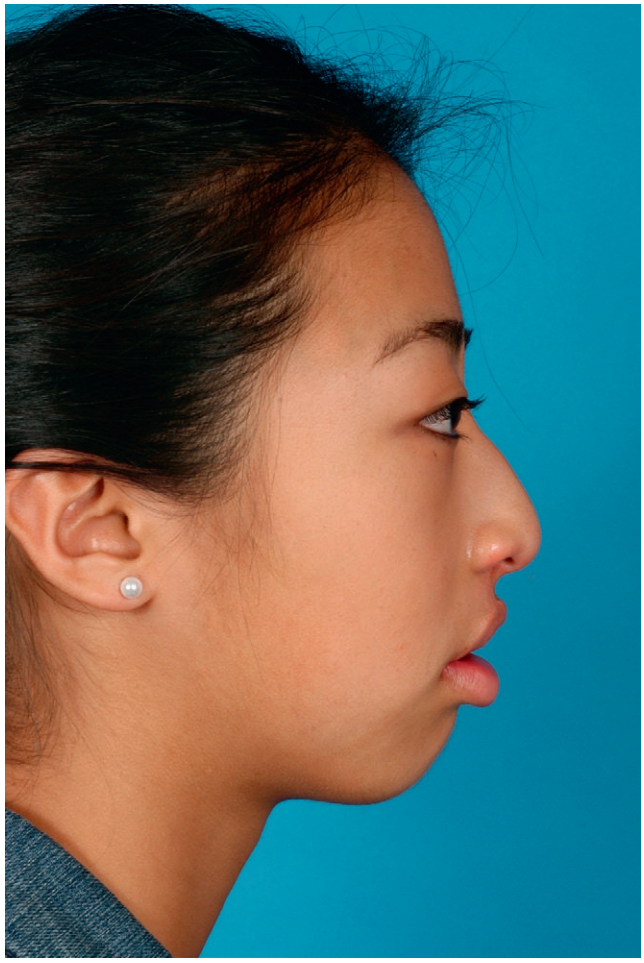


Figure 18.6 Profile view of an Asian nose.

BOX 18.6

Features of the Asian Nose on Profile View

- Low, shallow radix
- No or small hump
- Inadequate tip projection
- Deficient subnasale
- Prominent lips
- Microgenia
- Convex midface

On the profile view, the forehead is not commonly prominent, the radix is shallow and positioned low, there is a small hump or no hump at all, and the dorsum and tip are often underprojected. The nose is commonly short and the nasolabial angle is therefore very wide (Box 18.6; Figure 18.6).

Figure 18.7 Basilar view of an Asian nose.

BOX 18.7

Features of the Asian Nose on Basilar View

- Wide domes
- Short columella
- Horizontal nostrils
- Wide alar base (sill)
- Wide columella
- Displayed footplates

On the basilar view, the domes are wide, the columella is short, and the nostrils are oriented horizontally. However, Asian noses often have a better defined nostril sill. The columella is commonly wide and the footplates are not splayed (Box 18.7; Figure 18.7). Asian patients also have a limited cartilaginous portion to the septum, which is not as commonly deviated as it is in Caucasian and Middle Eastern noses.

Surgical Correction

The specific maneuvers required for correction of the Asian nose include a more common need for dorsal augmentation, tip graft, use of a columella strut, elongation of the nose, reorientation of the nostril, and removal of the redundant portion of the soft triangle lining. Asian patients also usually benefit from a genioplasty and augmentation of the premaxillary area as well as perialar augmentation. Use of an alar rim graft and columella strut in conjunction with removal of the soft triangle lining effectively creates more oval nostrils (Figure 18.8; Box 18.8; Animation 18.2).

Animation 18.2 •

Figure 18.8 Standard rhinoplasty views of the patient in Figure 18.5, who still had the common features of an Asian nose before (A, C, E, G) and 24 months after (B, D, F, H) correction of the deformity. Illustration of the technical steps for soft tissue (I) and frame alterations (J)

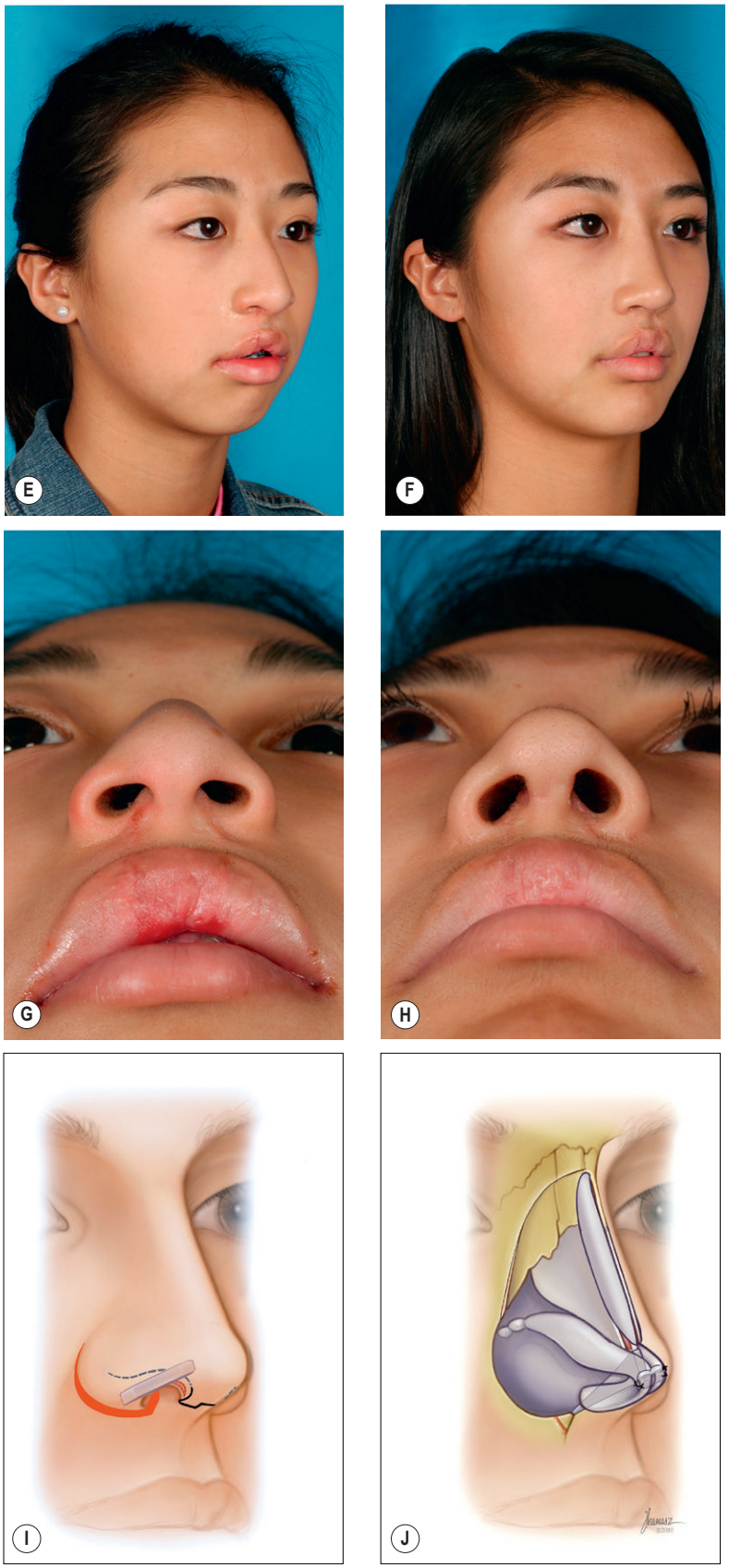


Figure 18.8, cont'd.

BOX 18.8

Surgical Steps: Figure 18.8

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was carried out
- A bilateral low-to-low osteotomy was carried out
- A columella strut was applied
- An onlay tip graft was applied
- A subdomal graft was applied
- A dorsal graft was applied
- Nasal spine osteotomy was performed and the nasal spine was repositioned in the midline
- The alar bases were narrowed with combined excision bilaterally
- Alar rim grafts were applied bilaterally
- The soft triangle lining was removed bilaterally

Middle Eastern Nose

Analysis

In general, Middle Eastern patients tend to require a greater degree of perfection, and they may be very aware of existing flaws. Often, the older generation expect conservative surgery, while at the same time looking for enough change to make the operation worthwhile. Some of the younger generation of Middle-Eastern patients prefer a more European nose, meaning a more drastic change. Middle Eastern faces are commonly narrower than those of Asians and African-Americans and present with variable skin thickness. Many Middle Eastern patients have some degree of dorsal deviation which often becomes more obvious after removal of the dorsal hump. The intercanthal distance is commonly narrow and reduction of the dorsum is advantageous to the appearance of the eyes. One should resist the temptation to augment the radix

Figure 18.9 Front view of a patient with typical features of a Middle Eastern nose, depicting the features listed in Box 18.9.

BOX 18.9

Features of the Middle Eastern Nose on Frontal View

- Variable skin
- Deviated dorsum
- Long nasal bones
- Narrow vault
- Long upper lateral cartilages
- Hanging tip
- Base asymmetry

significantly because it can adversely influence the appearance of the intercanthal distance. On the frontal view, the nasal bones are commonly long and the midvault is very narrow. Middle Eastern patients have longer upper lateral cartilages, as well as a dependent and poorly supported tip. The alar base is often asymmetrical and wide (Box 18.9; Figure 18.9).

Figure 18.10 Profile view of a Middle Eastern nose.

BOX 18.10

Features of the Middle Eastern Nose on Profile View

- Low radix
- Large hump
- Inadequate tip projection
- Dependent tip
- Hanging columella
- Deficient anterior nasal spine

On the profile view, the radix can vary significantly and is commonly deep and low. Many patients have a large hump. Tip projection is often inadequate and the tip is very much dependent on the anterocaudal septum. As the dorsum is lowered, additional loss of tip projection is produced. The tip often plunges significantly upon smiling. The columella is commonly hanging and the anterior nasal spine is usually deficient (Box 18.10; Figure 18.10).

Figure 18.11 Basilar view of a Middle Eastern nose.

BOX 18.11

Features of the Middle Eastern Nose on Basilar View

- Tip deviation
- Asymmetry
- Nostril asymmetry
- Deep soft triangle
- Displayed footplates
- Short columella

On the basilar view, the tip is frequently deviated to one side and the domes are asymmetric (Box 18.11; Figure 18.11). The nostrils are often uneven and there are deep facets anterior to the nostrils with redundant soft triangle lining and displayed footplates that contribute to the inadequate support of the tip and caudal displacement of the tip when smiling. The columella is commonly short and deviated.

Surgical Correction

Patients from the Middle East may or may not need a radix graft. Key steps for the successful correction of the Middle Eastern nose include adequate removal of the dorsal hump, which necessitates the use of spreader grafts or flaps. These patients almost invariably benefit from a combination of medial, anteroposterior and lateral osteotomies to avoid unfavorable fracture of the nose bones. These patients may benefit from removal of a wedge of bone between the nasal bone and the septum, to facilitate medial repositioning of the nasal bones. Placement of spreader grafts is usually necessary. Proper support of the nasal tip with a combination of a columella strut and approximation of the footplates, and tip graft are often necessary. It is crucial to rotate the tip cephalically using a combination of the maneuvers described in Chapter 4, including removal of a triangular piece of cartilage from the caudal septum based anteriorly, along with a proportional amount of membranous septum lining. Equally important is fixation of the medial crura to the anterocaudal septum using a 5-0 nylon tip rotation suture to ensure that the tip does not rotate caudally over time. Additionally, the lateral crura of the lower lateral cartilages may have to be transected and overlapped to avoid kinking and to allow stable and enduring rotation of the tip cephalically. Placement of the columella strut commonly overcomes the deficiency in the nasal spine. During insertion of the columella strut, the depressor nasi septi muscle is detached, which reduces the likelihood of the nose tip being pulled caudally. This positive effect is further reinforced by the support that the columella strut provides to the caudal limb of the nasal tripod. Narrowing of the nasal bones should be conservative to avoid the appearance of too much reduction in the intercanthal distance. Many patients benefit from the use of an alar rim graft or a lateral crura strut. A thorough septoplasty with or without inferior turbinectomy is essential to correct the deviated external nose and improve nasal function. This combination of maneuvers often results in a pleasing outcome (Figure 18.12; Box 18.12; Animation 18.3).

Animation 18.3 •

Patients from the Middle East have a slightly higher tendency to bleed excessively despite having normal routine blood test results, which can often be overcome by using desmopressin.

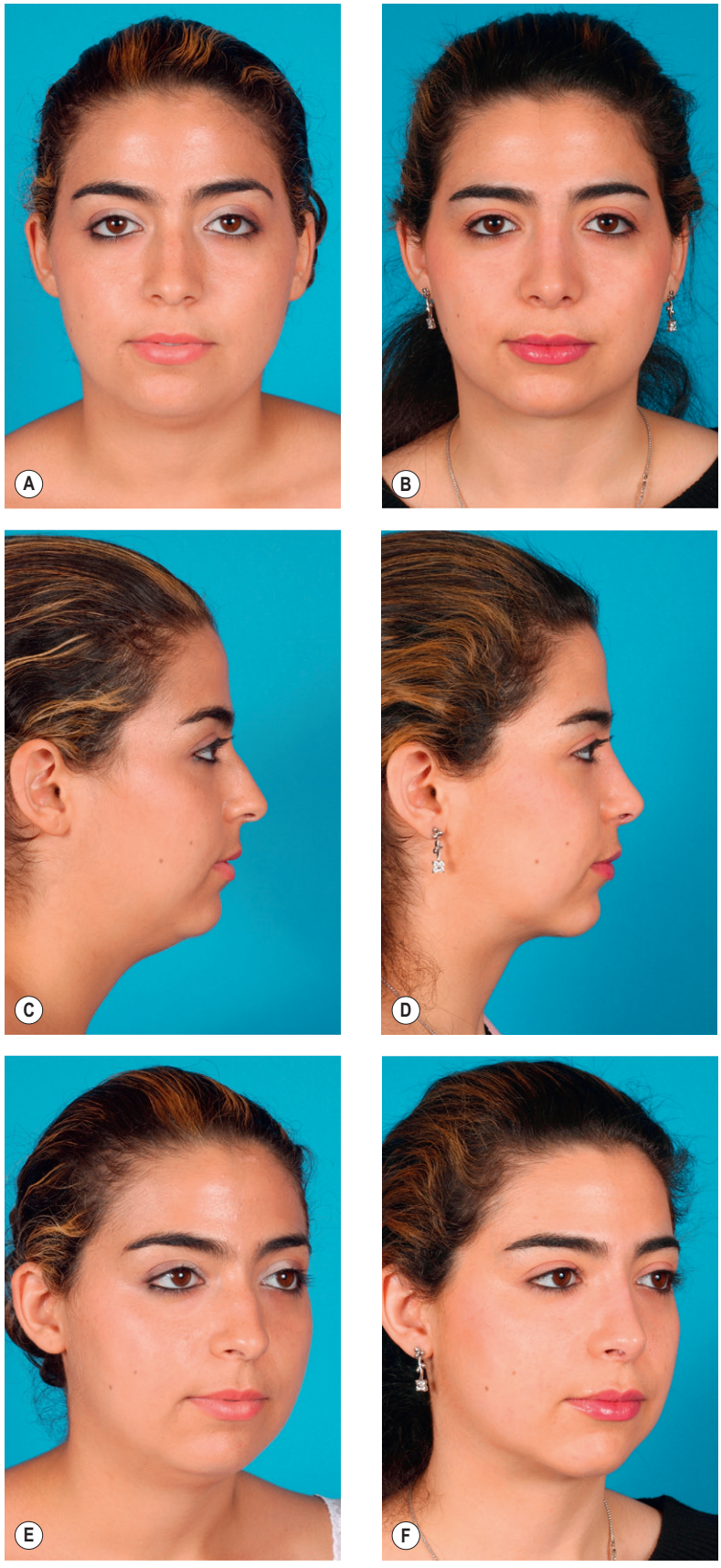
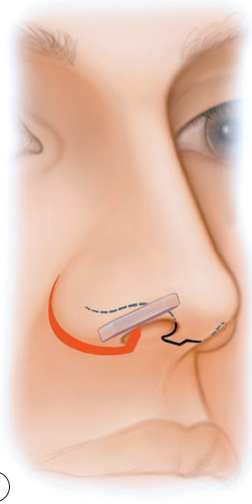


Figure 18.12 A typical Middle Eastern nose before (A, C, E, G) and 19 months after (B, D, F, H) rhinoplasty and submental lipectomy. Illustration of the technical steps for soft tissue (I) and frame alterations (J).



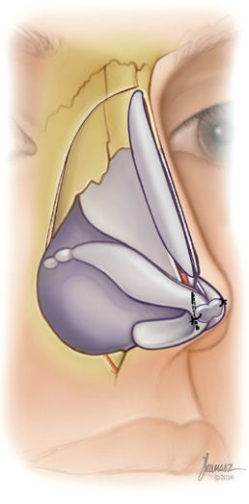


Figure 18.12, cont'd.

BOX 18.12

Surgical Steps: Figure 18.12

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was carried out
- Bilateral medial, cephalic, percutaneous, and lateral low-to-low osteotomies were performed
- Bilateral spreader grafts were applied
- Transdomal sutures were placed
- An onlay tip graft was applied
- Nasal spine osteotomy was performed and the nasal spine was repositioned in the midline
- The alar bases were narrowed with combined excision bilaterally
- Alar rim grafts were applied bilaterally
- A septal rotation suture was placed
- The upper lateral cartilages were approximated to the septum.

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19 CHAPTER

Secondary Rhinoplasty

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Pearls

- In communicating with secondary rhinoplasty patients, any statement or gesture of disapproval of what was done during the previous surgery should be avoided.
- Patients who have telangiectasis as a result of the initial surgery may experience deterioration of this condition after the secondary surgery.
- The telangiectasis can be eliminated with vascular laser (wavelength 585 nm).
- For patients with thin skin, one has to be prepared to use fascia, dermis, or perichondrium to augment the soft tissues.
- The inverted V deformity is not usually discernible intraoperatively or for some time after the surgery, often taking 6 months and up to one year or longer to become noticeable.
- Over-resection of the supratip structures, which may cause a dead space filled with blood and formation of fibrofatty tissues, or under-resection of the caudal dorsum followed by loss of tip projection, can result in formation of supratip (Polly beak) deformity.
- Dome division techniques without additional measures can result in too much narrowing of the tip, bossae formation, asymmetry, migration of the medial crura and medial genu caudally over a long period of time, and loss of projection due to loss of stability of the tip triad.
- Patients who seem to have unrealistic expectations, demand perfection, or make disparaging remarks about the previous surgeon may not be suitable candidates for a secondary rhinoplasty.
- Due to scar tissue, dissection through an open technique following a previous exonasal surgery is far more time-consuming than this operation after a previous endonasal approach.
- Overcorrection of the radix deficiency can be significantly more detrimental to the facial balance than the deficiency itself and may make

the eyes appear too close to each other, which in most cases is undesirable.

- Revision surgery for a large residual dorsal hump may require osteotomy to narrow the distance between the nasal bones and also the use of spreader grafts.
- A cephalocaudal groove over the mid-portion of the nasal bone due to an anterior position of the osteotomy can be corrected with a second osteotomy in a low-to-low level.
- For a larger dorsal defect, a septal or conchal cartilage graft has to be used, although this goal can also be accomplished using diced cartilage graft. A smaller dorsal defect can be eliminated using a piece of conchal cartilage graft.
- For patients who have significantly attenuated lower lateral cartilages with major collapse of the internal valve, a splay graft would be best.
- For an isolated inverted V deformity without dorsal profile deficiency, bilateral spreader grafts can be inserted through a small incision approximately 3 mm long and placed anteroposteriorly along the caudal border of the lower lateral cartilages.
- For secondary rhinoplasty patients with a deficient lobule volume, either an onlay or a shield graft can be used if infratip lobule volume augmentation is also necessary.
- While a differential level of 6–10 mm between the domes and the dorsum is necessary on primary rhinoplasty patients, this reduces to 3–4 mm on most secondary patients, especially if the tip skin is thin.
- A nostril can be elongated on a secondary rhinoplasty patient by using a combination of a columella strut, approximation of the footplates, removal of a crescent piece of soft triangle lining and application of an alar rim graft.
- Presence of a significant amount of scar tissue may limit the success of secondary rhinoplasty.
- To repair a chronic perforation of the septum through a small transfixion incision, a pocket is created involving the perforation site and extending beyond the margins. A straight piece of septal cartilage or a perpendicular plate of the ethmoid bone or PDS plate is placed in position, and extramucosal splints are applied to both sides, to avoid free flow of air, and kept in position for at least two weeks.
- Many secondary rhinoplasty patients who have had a partial turbinectomy involving either the anterior or posterior portion of the turbinate will have a compensatory enlargement of the intact portion of the turbinate.

Since rhinoplasty is truly a precision surgery and given the number of interplays that occur during each maneuver, achieving a perfect outcome consistently is very difficult. A change of even a quarter of a millimeter makes a difference to the outcome. As a result, the chance for revision surgery is higher than with many other procedures. Additionally, the need for

a revision surgery is directly linked to the patient's and surgeon's level of perfectionism. What may seem optimal to some may look flawed to others. A revision rhinoplasty can be aimed at correcting some minor flaws or could involve undoing the steps taken during primary rhinoplasty and redoing the entire rhinoplasty.

Dealing with the secondary rhinoplasty patient is totally different from attending to a patient who is undergoing a primary rhinoplasty. A secondary rhinoplasty presents additional emotional, physical, and anatomical challenges.[1–5] A positive outcome requires a clear understanding of patient concerns, precise definition of nasal flaws, and establishment of achievable goals. Thorough knowledge of the nuances and potential problems as well as additional prudence during the surgery are necessary to deliver a satisfactory outcome. In this chapter, the author will discuss the elements that set a secondary rhinoplasty apart from a primary rhinoplasty, the many nuances that govern the management of secondary rhinoplasty patients, patient assessment, surgical planning, technical details, and graft sources.

Patient Evaluation

Secondary rhinoplasty patients have usually spent a great deal of time analyzing the imperfections of their nose and are armed with a basic understanding of the problem that most primary rhinoplasty patients do not have. Commonly, many of these patients have consulted several surgeons and are fully informed of the potential limitations of secondary surgery. This extensive research may be undertaken partly because the patient feels that they contributed to the failure of the primary rhinoplasty by not questioning the surgeon and investigating the proposed procedures sufficiently prior to the initial surgery, and they are determined not to repeat the same error.

The first requirement for successful management of secondary rhinoplasty is to listen carefully to patients' concerns in order to understand the reason for their dissatisfaction. The surgeon must determine whether the patient's discontent has a valid foundation and note how their concerns are expressed, as this may provide tangible evidence of their level of perfectionism, expectations, and likelihood of being pleased with the results of the secondary surgery. A statement such as 'My nose has been butchered', when a circumspect examination unveils only minor flaws, may suggest a patient who exaggerates, may have unrealistic expectations, and may ultimately remain dissatisfied in spite of a resoundingly successful rhinoplasty outcome. Conversely, a patient who makes conciliatory remarks about the former surgeon and surgery, despite the fact that the previous procedure has produced grossly suboptimal results with many major flaws, is likely to be satisfied with the results of additional rhinoplasty even if it does not deliver all the intended goals.

A patient seeking a primary rhinoplasty may not be cognizant of any functional difficulties, while a secondary rhinoplasty patient is often clearly aware of the limitations in breathing commonly associated with flaws in the form of the nose. While the former group has no base with which to compare current breathing capacity, the latter group is able to compare current breathing with their breathing before the primary rhinoplasty. Therefore, such patients are keenly aware of the reduced functional capacity of the nose. A deterioration in breathing is often the result of valve dysfunction caused by malposition of the upper lateral cartilages, nasal osteotomy, and medial repositioning of the nasal bone, which can often dislodge the inferior turbinates and the upper lateral cartilage, or of external valve dysfunction.[6–8] However, some airway deterioration is related to the failure of the previous surgeon to recognize underlying breathing problems and marginal airflow that were easily disturbed by even minor anatomical changes.

Having experienced a major disappointment after the primary rhinoplasty, patients seeking a secondary rhinoplasty often demonstrate more apprehension and uncertainty. Understandably, such patients are frustrated because they have incurred substantial costs and spent time and energy in planning and undergoing the previous surgery and recovery. They expected a gratifying outcome, yet ended up being dissatisfied. This failure to achieve anticipated goals commonly transforms into distrust of and negative feelings towards plastic surgeons. Demonstration of legitimate compassion, patience, and confidence, reinforced with a precise outline of the nasal flaws and a succinct description of the surgical plans, may restore the buoyancy essential for the patient to return to the operating room with comfort and confidence.

It is important to allocate enough time for the consultation and not to give the patient the impression of rushing through the conversation. Frequently, such patients spend a lot of time exploring the reason for the failure of the previous surgery. It is crucial to redirect the focus on to the current problem and future solutions. Patients are often searching for some remark, a shake of the head, or any gesture of disdain that confirms their suspicion that something was done improperly during the initial surgery to cause the discouraging outcome. This type of unjustified confirmation of the patient's misgiving should be avoided unless there is concrete evidence of some mishap occurring during the previous procedure. In fact, simple reiteration of the fact that it is uniformly agreed that rhinoplasty is complex and that all surgeons experience some suboptimal results and end up revising some of their rhinoplasty outcomes may avert legal action that would entail a disappointing outcome for the patient, as there is often no substance to their claim. Invariably, an inexperienced surgeon hearing a one-sided story risks unjustifiably accusing the previous surgeon of wrongdoing. Any negative statement or judgment should be avoided until all the facts become clearly known to the surgeon who is asked to give an opinion.

It is important to make a genuine effort to return the patient to the previous surgeon. This is a professional courtesy and something that surgeons hope and expect that other surgeons will do with their patients. However, the patient's best interests should always prevail. Whenever the previous surgeon's skill or judgment is proven to be substandard, the patient should be attended by a surgeon who is able to deliver superior care.

Physical Assessment of the Nose

It is important to determine, through a careful examination, whether a septoplasty and turbinectomy has been performed. Any surgical steps recorded in the operative notes available from the previous surgery should be substantiated by the examiner. There is a tremendous variation in the magnitude of septoplasty and this can only be ascertained by a thorough examination. The forceful opinions and statements of secondary rhinoplasty patients about their noses can be a source of distraction, wrongly causing the surgeons they visit to focus attention directly on the nose rather than on the entire face. It is therefore imperative to examine the complete face before centering the attention on the nose. Any imperfections marring the forehead, such as prominence or retrusion; chin abnormalities, including macrogenia, microgenia, or asymmetry;[9–10] underdevelopment of the malar bones; and maxillary and mandibular disharmony should be noted. Sometimes, these factors are substantial sources of incongruity. For example, a severely receding chin may make the nose appear overprojected when in reality the problem is the chin deficiency. Should disharmonies of the face related to the other structures go undetected, the outcome of the secondary surgery, like the primary surgery, will still be disappointing. The flawed features should be brought to the patient's attention and corrected, if the patient is in agreement. Insistence on correcting these additional imperfections of the face as a condition of proceeding with the rhinoplasty should be avoided. However, it is crucial to inform the patient of the consequences of not correcting other flaws that indirectly will influence the rhinoplasty outcome.

As in assessment of a primary rhinoplasty patient, the external nose examination begins with observation of the thickness of the skin. If the patient has thick, sebaceous nose skin (Figure 19.1), it is likely that, at least to some degree, the previous surgery failed because of this unfavorable condition. If skin thickness was a major factor, subsequent surgery may not produce a much improved outcome unless the condition of the skin is changed as much as feasible. This adverse condition should be discussed with the patient to reduce the patient's expectations of surgery. Patients with heavily sebaceous skin are suboptimal candidates for an external incision, whether it is used for an open technique or in alar-based surgery. Referral to a dermatologist and a resolute effort to reduce the sebaceous and porous nature of the skin

Figure 19.1 A secondary rhinoplasty candidate with significant sebaceous activity causing thickening of the skin.

may prove helpful in these circumstances. Tretinoin or isotretinoin can be prescribed under the supervision of a dermatologist to lessen the activity of the sebaceous glands. However, surgery should then be delayed for at least 6 months to minimize the potential of excessive bleeding and formation of hypertrophic scars in those taking tretinoin. Additionally, the technique should be modified to achieve better tip definition for patients with thick skin in the tip area, creating a narrower tip frame. Furthermore any supratip dead space should be eliminated by approximation of the skin to the underlying frame. Otherwise blood can accumulate in this space and ultimately convert to fibrofatty tissue. This obscures the definition of the nose and often results in a supratip deformity (see Chapter 15).[11]

Figure 19.2 A secondary rhinoplasty candidate with telangiectasis.

Patients who have telangiectasis as a result of the initial surgery may experience deterioration of this condition after secondary surgery (Figure 19.2). Informing the patient of the potential for this will avoid dissatisfaction and prepare the patient for postoperative treatment with vascular laser (wave length 585 nm) to reduce or eliminate telangiectasis. Observation of suboptimal scars from previous surgery may predict similarly poor scars following secondary rhinoplasty. The patient should be forewarned of this possibility, if it is detected.

Some patients have thin skin (Figure 19.3), particularly over the dorsum of the nose, as a result of dissection in a plane superficial to the periosteum during the previous surgery, which ultimately results in removal of the periosteum along with the residual hump. This is why the importance of dissecting in the subperiosteal plane during primary surgery is stressed, to ensure that the periosteum is maintained to cover the underlying frame. Patients with thin skin should be informed that they may need one of a variety of soft tissue grafts, such as dermis, fascia, or perichondrium. When the skin is very thin, it may take on a red or purplish color, which often becomes a source of concern to the patient. This is particularly likely when dorsal augmentation has been achieved using alloplastic materials. The discoloration may be more

Figure 19.3 A patient with thin skin after multiple previous surgeries.

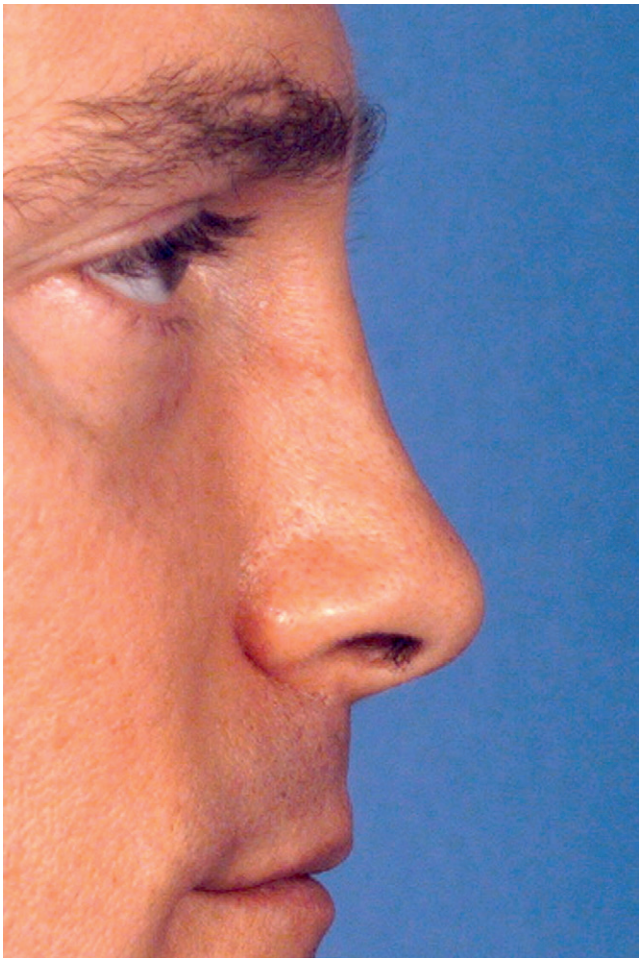


Figure 19.4 A patient with an under-reduced radix and over-resected dorsum.

obvious in a cold environment. When a soft tissue graft is added to the dorsum, the skin color may return to normal.

The Radix

After examination of the skin, the external nose is assessed in an organized fashion starting from the radix. A shallow radix, which produces a displeasing transition from the forehead to the dorsum, is extremely common. Failure to use the effective tools available to lower this site is the most common reason for failure to correct radix fullness (Figure 19.4). Another common finding is a radix that is too deep. Usually, this is a pre-existing condition that

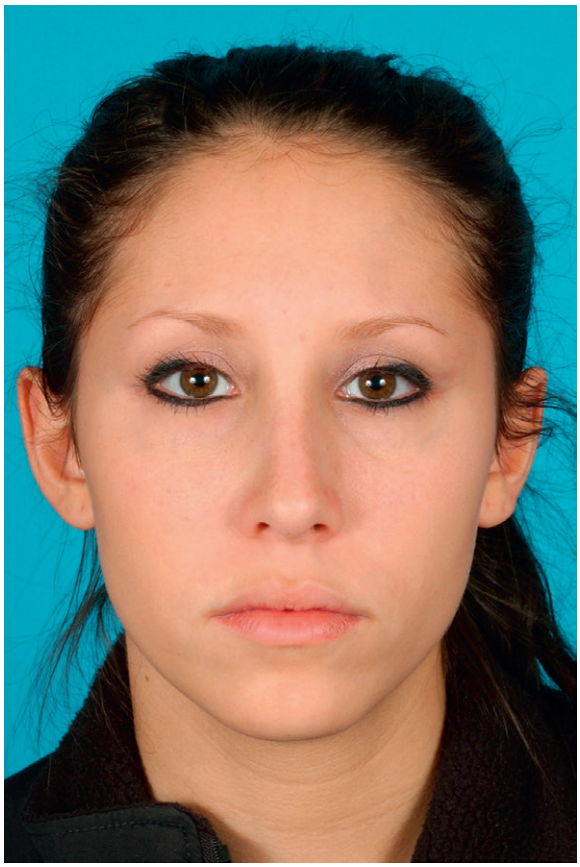


Figure 19.5 A patient with dorsal irregularity requiring a secondary rhinoplasty.

Figure 19.6 A patient demonstrating step deformity due to the anterior position of the osteotomy.

has not been corrected adequately. However, in some patients the radix may have been over-reduced.

The Bony Dorsum

Examination of the nasal bones may disclose some irregularities, a very common cause of concern for secondary rhinoplasty patients. Optimally, one would like to see two parallel dorsal lines extending from the eyebrows to the supratip area without any interruption. Frequently, these lines are interrupted because of imperfections in the nasal bones (Figure 19.5). When the nasal bone osteotomy is carried out low-to-high (too anteriorly), rather than low-to-low, a step created by the osteotomy may be seen midway between the dorsal line and the junction of the nose with the face (Figure 19.6). Other dorsal imperfections include a dorsum that is too narrow or too wide.

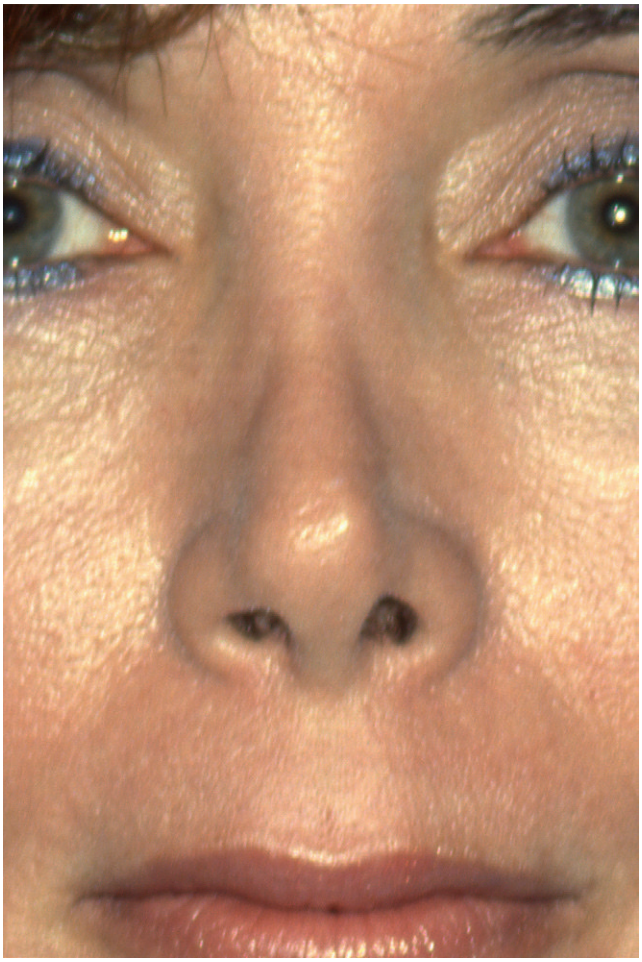


Figure 19.7 A secondary rhinoplasty patient with an inverted V deformity.

The Midvault

The midvault can also be marred by excess width or too much narrowing, creating an inverted V deformity (Figure 19.7). This is almost invariably the result of over-resection of the midvault and loss of support of the upper lateral cartilages, allowing them to shift medially and consequently narrowing the internal valve. Over-resection of the dorsum also results in depression in the midvault area. An increased awareness of this flaw and repeated recommendations at rhinoplasty educational courses to use spreader grafts have reduced the incidence of this deformity. The deformity is not usually discernible intraoperatively or for some time after surgery, often taking 6 months and occasionally up to 1 year to become noticeable. Rarely, in patients with very thick skin, it can take several years before the deformity is detectable. Some inverted V deformities are not noticeable even for decades, until the skin thins as a result of aging.

Figure 19.8 A patient with residual caudal dorsum fullness causing supratip deformity.

The Supratip Region

The role of the supratip break in the aesthetics of the nose has been underemphasized. Over-resection of the supratip structures, creating too much of a differential level between the domes and the anterocaudal septum, can result in exaggerated supratip definition, although this is not nearly as displeasing as supratip fullness causing a supratip or 'Polly beak' deformity. This deformity is sometimes a consequence of too much resection of the dorsum and failure to eliminate dead space, which can result in collection of blood and ultimately the formation of fibrofatty tissue,[11] as mentioned above. However, it is not uncommon to have supratip fullness related to the residual anterocaudal dorsum (Figure 19.8), which may become further exaggerated by loss of tip projection during healing. In secondary rhinoplasty patients, detection and correction of this flaw constitutes a principal step without which neither the patient nor the surgeon will be pleased.

Tip Flaws

The critical role that the tip plays in the desirability of the rhinoplasty outcome is uniformly recognized. To state that no rhinoplasty outcome can be gratifying without optimal tip definition and projection would not be an exaggeration. The tip can be flawed in a variety of ways. Some imperfections are related to width imbalances, which may present as a wide tip resulting from unleashing of the domes following resection of the cephalic portion of the lower lateral cartilages in the form of 'bossae'. Dome division and multiple suture techniques, or resection of the domes, can result in too narrow a tip. Additionally, the tip can have inadequate or excess projection, both of which constitute a suboptimal outcome. Asymmetry is extremely common in this area and is often the result of discrepancy in the size of the lower lateral cartilages, which often goes undetected. Additionally, if a tip graft has been applied, it can sometimes shift, creating asymmetry. The tip can also appear like a clover leaf in the basilar view as a result of concavity of the alae. This imbalance makes the tip appear larger, even if it is not excessively wide.

The Nasal Base

The nasolabial angle is another aesthetic feature that plays an enormous role in the congruity of the nose. Cephalic over-rotation of the tip, causing an obtuse angle, is a hallmark of rhinoplasties performed in the 1970s and early 1980s. Ironically, a large number of secondary rhinoplasty patients today have a narrow nasolabial angle and are dissatisfied because the tip is not adequately rotated cephalically. Furthermore, the columella may appear too caudal (Figure 19.9) or too cephalad in relation to the rim. There are patients who have hanging ala, giving the appearance of a retracted columella even though the flaw does not actually involve the columella. Similarly, patients may have a retracted alar rim, which is extremely common (Figure 19.10), and makes the columella look as if it is protruding excessively. The alar base can be asymmetric, too wide, or, rarely, too narrow. The alar base can also be either cephalically or caudally malpositioned.

A basilar view may demonstrate misshapen nostrils, dome malposition, asymmetry, excessive infratip lobule volume with short nostrils, or nostrils that are too long with sufficient lobule volume, causing an imbalance of the basilar unit (Figure 19.11). In this view, one commonly sees a deviation of the columella, footplate malposition, and alar base asymmetry.

Nasal valve function should be assessed by asking the patient to inhale forcefully (Figure 19.12). This will reveal any collapse of the internal or external valves. Examination of the nasal valve using a speculum or a Q-tip can provide additional information and confirm nasal valve dysfunction seen on external observation. Such patients should also be examined carefully to assess the amount of residual septal cartilage, presence, location and size of a potential septal perforation, enlarged turbinates, and the presence of

Figure 19.9 A patient with a protruding columella and retracted ala.

Figure 19.10 Retracted ala may misleadingly result in the appearance of protruding columella.

synechiae, polyps, or other abnormalities that could be causing airway compromise. The septum should also be carefully examined for residual deviation, which is extremely common.

Cephalometric analysis of life-size digital photographs, as described in Chapter 2, can reveal other nasal imperfections, as well as other facial disharmonies that can easily go undetected. When these photographs are analyzed, they provide a precise blueprint of the proposed surgery, with changes specified to the nearest 0.25 mm, which can be extremely helpful intraoperatively and during discussion of the surgical plan with the patient.

Timing and Indication for Surgery

There is consensus among rhinoplasty experts that secondary rhinoplasty or revision surgery should not ordinarily be performed until about 1 year after the initial surgery. The rationale behind this policy is that, usually, the initial

Figure 19.11 A basilar view of a secondary rhinoplasty patient demonstrating a variety of flaws.

Figure 19.12 Asking the patient to inhale forcefully discloses collapse of the internal valve.

swelling has not completely subsided and scar tissue remodeling underneath the soft tissues is not complete until about 1 year postoperatively, especially in the tip area. During this year, the nose goes through active changes and the swelling sometimes fluctuates, being most noticeable in the morning upon awakening and subsiding as the day goes on. Premature surgery in such patients may mandate another procedure when the swelling has completely subsided and the scar tissue has fully remodeled. However, there are exceptions to this policy. If there is a significant deformity that either causes major functional disturbance or interferes with the patient's social or professional life, secondary surgery may be embarked upon earlier than 1 year after the primary procedure, as long as both patient and surgeon understand that, when the nose heals completely, there may potentially be a need for additional surgery.

It is often necessary to meet secondary rhinoplasty patients at least twice to make sure that there is complete mutual understanding about the concerns and the surgical plans. This offers additional observation time. It is crucial to discuss the possibility of the use of conchal or costal cartilage graft with these patients. Every patient should go to the operating room understanding that either of these cartilage sources could be used and there should not be any limitation in the way of achieving the aesthetic goals. Additionally, patients who have thin skin should be prepared for the use of perichondrium from the ear or rib, and even a fascia or dermis graft if necessary. If patients are to undergo major revision, it is crucial that they are informed of the possibility of additional surgery. They must clearly understand that scar tissue from the primary surgery may reduce the predictability of the outcome, and they may need cartilage or soft tissue grafts.

Patients who have a comprehensive understanding of the nature of the problem are less likely to be dissatisfied postoperatively. This includes the majority of patients today, who search the Internet and have an in-depth knowledge of anatomy, pathology, surgical maneuvers, and potential outcomes. Patients who seem to have unrealistic expectations, producing a sense of unease in the surgeon, and those who demand perfection, or make disparaging remarks about the previous surgeon, may not be the most suitable candidates for secondary rhinoplasty (see Box 2.1 in Chapter 2).

Surgical Correction of Secondary Nose Imperfections

The rhinoplasty maneuvers available to correct flaws in the operated nose may be minor, intermediate, or major. In the latter case the secondary rhinoplasty often exceeds the primary rhinoplasty in complexity. An example of a minor revision would be correction of residual dorsal irregularity, or the need

to apply an isolated tip or spreader graft, which can be performed under local anesthesia with intravenous sedation. General anesthesia, however, is preferred for those patients requiring intermediate or major revisions, mainly because the diffusion of local anesthetic on such patients is often suboptimal and uneven. With local anesthesia, patients who are sedated deeply enough to be comfortable may not clear blood and secretions sufficiently from their nasopharynx, increasing the chance of aspiration of blood. On the other hand, inadequately sedated patients may become garrulous, distracting the surgeon, or may experience discomfort. Furthermore, many procedures may appear to be short and simple, but when one starts carrying out the surgery, especially when using an open technique, further imperfections may be discovered that require a lengthier procedure than planned.

Choice of Approach

Many minor imperfections can be corrected predictably using a closed technique. However, the exonasal approach is optimal for those who require an intermediate revision or a full secondary rhinoplasty, especially when tip revision is a significant part of the plan.[12–13] This exposure is particularly good for visualizing and eliminating tip abnormalities. Since some alteration in the circulation pattern will have occurred as a result of the previous surgery, the skin flap usually has a different blood supply, mostly through the surrounding soft tissues rather from the underlying structures, rendering the open technique safe.

If the initial surgery was carried out using an endonasal approach, a secondary open rhinoplasty is not ruled out. The success of the operation is directly related to the surgeon's ability to identify the flaws preoperatively and correct them under adequate exposure, using the open or closed technique. Many such imperfections can be readily assessed during the external examination and an experienced surgeon can anticipate fairly accurately what will be found under the soft tissues. However, it is not always possible to fully delineate the structural flaws, especially in the tip area, by means of a physical examination. Thus, some surprises should be expected and the surgeon must be prepared to deal with such unanticipated findings. Due to scar tissue, dissection through an open technique following a previous exonasal surgery is far more time-consuming than this operation after a previous endonasal approach.

Surgical Technique

The nose is prepared in a similar way to the primary rhinoplasty. Following induction of anesthesia, the nose hair is trimmed and the face is prepped and draped. Lidocaine containing 1:200 000 epinephrine is initially injected into the turbinates if a turbinectomy is anticipated and the nose is then packed with a gauze saturated in Neo-Synephrine™. The external nose is then injected

thoroughly, as for a primary rhinoplasty. After allowing a few minutes to maximize the vasoconstrictive effect of the epinephrine and to minimize the systemic response of the second injection with a higher concentration of epinephrine, the injection is repeated, this time using 0.5% ropivacaine containing 1 : 100 000 epinephrine. A step or a horizontal incision with an inverted V component is made in the columella following the original open incision. If the original scar is unacceptable, it can be excised. The soft tissues of the nose are separated from the tip frame and the dorsum by careful dissection. A great deal of scar tissue may be encountered, rendering the dissection exceedingly challenging, notwithstanding the type of incision or exposure used previously.

Balancing the Radix

Two common abnormalities of the radix, as mentioned earlier, include a radix that is too shallow or one that is too deep. Excessive fullness of the radix can be corrected by removal of the bone from this site using a guarded burr[14] (see Video 4.9 in Chapter 4). After sufficient elevation of the soft tissues, and making sure that the dissection is in the subperiosteal plane, the guarded burr is introduced in the space between the bone and periosteum and advanced cephalically. The nasion is deepened incrementally (Figure 19.13; see Video 4.9 in Chapter 4) by activating the burr and gently moving it from side to side. It is absolutely crucial to avoid directing the burr cephalocaudally. It is also essential not to run the burr for too long without cooling since it can cause thermal damage, resulting in a postoperative seroma. Extreme caution should be exercised, since the tool is very powerful and can easily result in excessive bone removal if used too zealously. The principles discussed in Chapter 4 should be exercised here. The deepest portion of the radix should be at the level of the orbital fissure or minimally above it, i.e. at the level of the supratarsal crease in a straight gaze.

A radix deficiency can be corrected with the use of a small amount of gently crushed or diced cartilage graft. Again, caution should be exercised, since

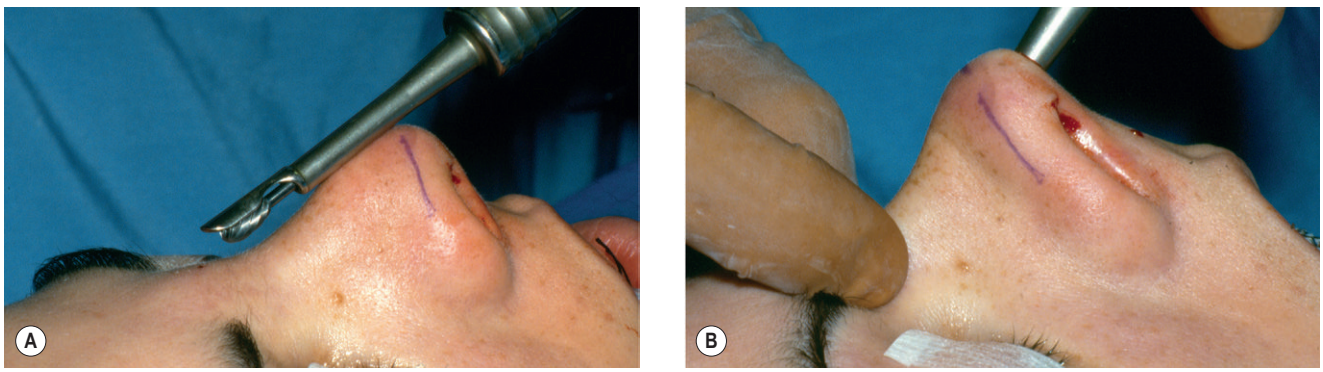


Figure 19.13 Use of a guarded burr facilitates deepening of the radix.

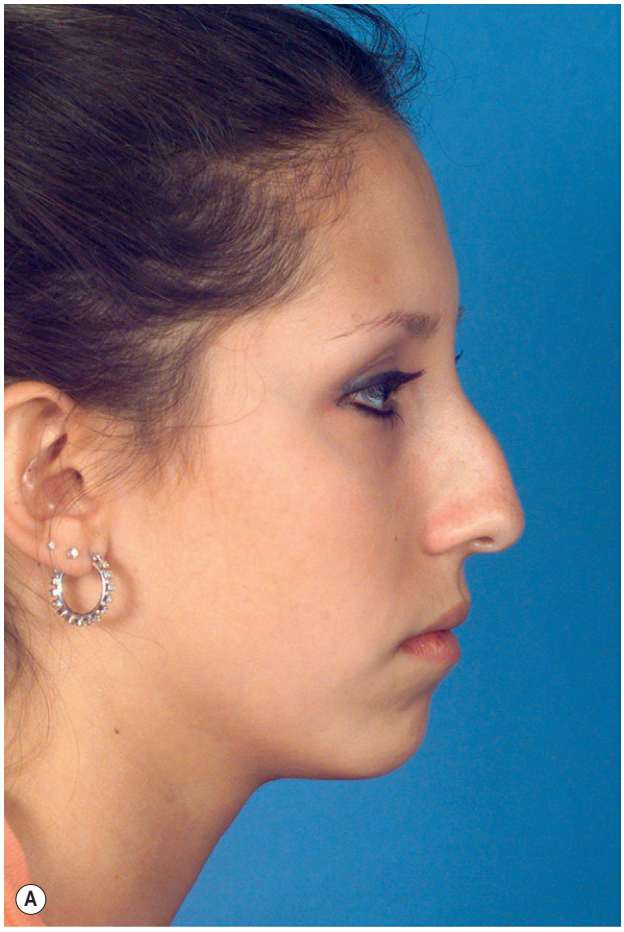
overcorrection of this deficiency can be significantly more detrimental to facial harmony than the deficiency itself and may make the eyes appear too close to each other, which in most faces is undesirable. A pocket is created that precisely accommodates the graft, which is delivered to the site and gently molded in place, creating a smooth transition from the forehead to the dorsum. As long as the pocket is dissected properly, fixation of the graft is not necessary.

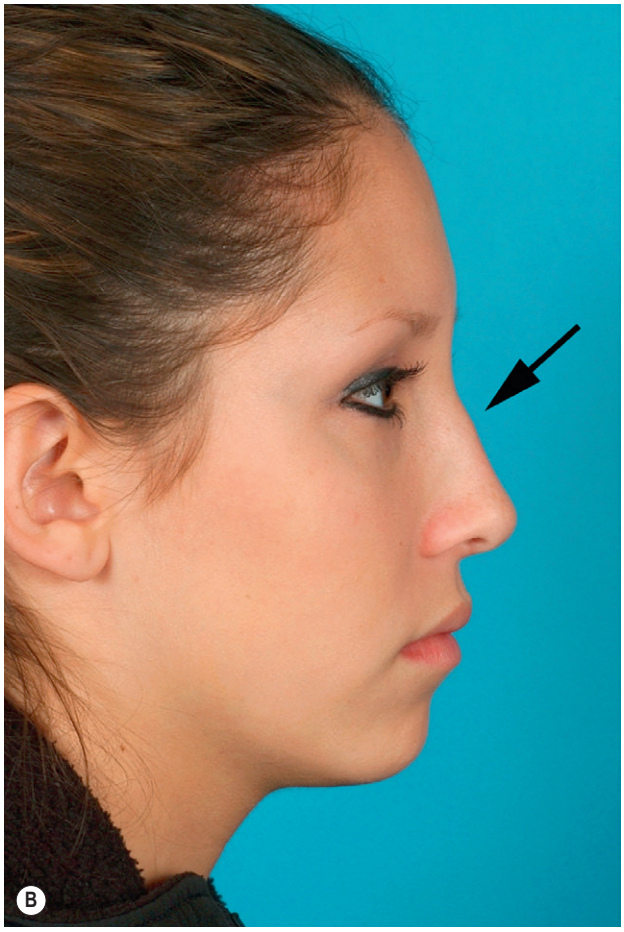
Elimination of Residual Dorsal Hump

Because of the edema of the soft tissues overlying the dorsum, detection of persisting dorsal irregularities and a residual hump is often difficult intraoperatively, leading to the common requirement of a secondary procedure at this site. Repeated palpation of the dorsum with a wet, gloved fingertip and direct observation can minimize the need for this revision. If the residual dorsal hump is an isolated problem that does not require spreader grafts or osteotomies, this can easily be accomplished using a closed technique through an intracartilaginous incision. The dorsal soft tissues are elevated in the subperiosteal plane. This can be very difficult in secondary rhinoplasty patients because of the firm adhesion of the periosteum to the underlying bone and the dorsal cartilages. However, every attempt should be made to elevate all the soft tissues before the residual hump is removed. Otherwise, as was mentioned previously, the soft tissues left attached to the dorsal frame will be removed with the hump, reducing the thickness of the soft tissue cover blanketing the dorsum and making any minor imperfection of the dorsum more obvious. The bony portion of the hump can easily be removed with a rasp and the cartilaginous hump is removed with a no. 15 blade. Use of an osteotome, especially for removal of small residual dorsal humps, can be difficult and is usually imprecise. Since this type of irregularity is not purely bony, an osteotome may not remove it sharply in a single piece, or may remove too much or too little (Figure 19.14).

If the residual hump is significant, its removal will invariably result in widening of the dorsum, which should be recognized. Otherwise, one imperfection is being traded for another and both patient and surgeon will be displeased with the outcome. It is therefore crucial to prepare patients who undergo removal of a residual large hump for an osteotomy and a dorsal splint. Also, when the residual hump is significant, one must also be prepared to use spreader grafts to avoid too much narrowing of the dorsum and an inverted V deformity following osteotomy. The mucoperichondrium should be dissected and elevated intact to avoid an open roof as far as possible. In the absence of an osteotomy, simple taping for 3–4 days with SteriStrips™ is sufficient to eliminate the space between the soft tissues and underlying frame.

Besides the residual dorsal hump, the nasal bones may be asymmetrical (Figure 19.15), too far apart, or, rarely, too narrow. If the asymmetry is related to the depressed nasal bone, the bone can be osteotomized and moved





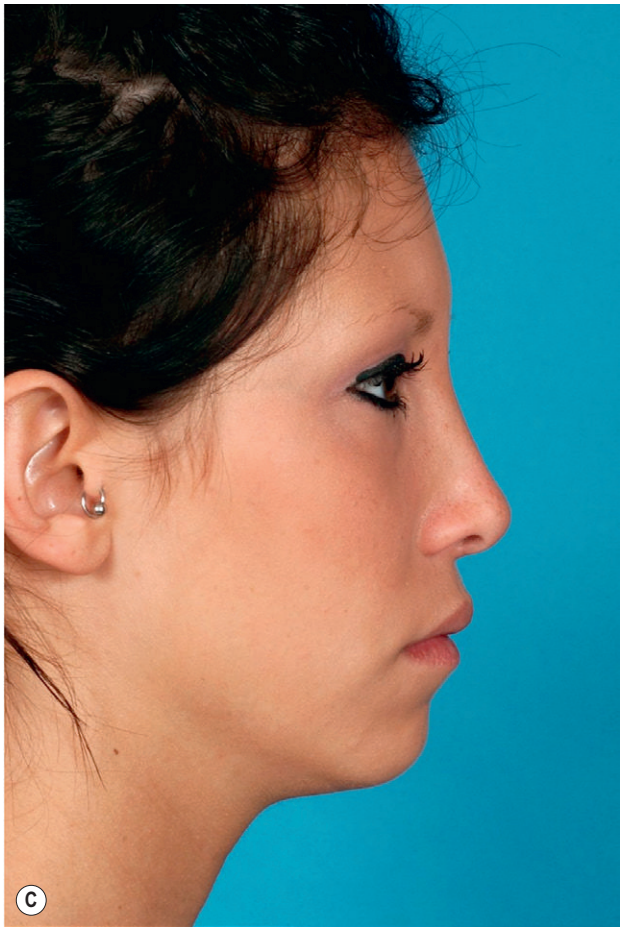


Figure 19.14 A patient before (A) and 1 year after primary rhinoplasty (B), demonstrating a residual dorsal hump. (C) 29 months after a secondary rhinoplasty to remove it.

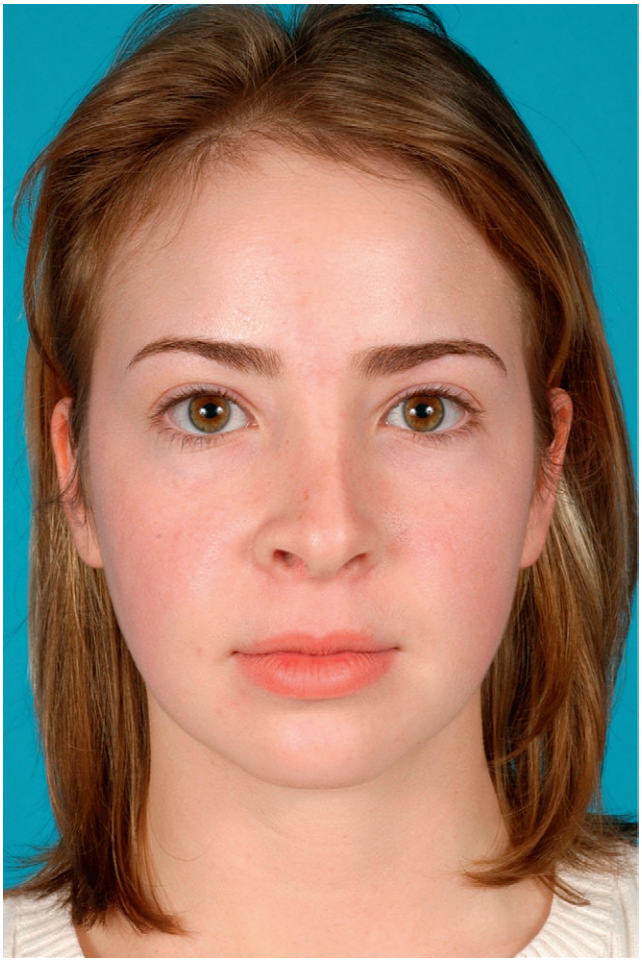


Figure 19.15 A secondary rhinopalsty patient demontrating a significant asymmetry.

laterally. If this is done as a greenstick fracture, a spacer may not be necessary. However, extension of the spreader graft cephalically may maintain the nasal bone laterally until it heals. Use of folded Surgicel™ can help to maintain the position of the nasal bone. To perform the osteotomy, a stab incision is made in the vestibular lining at the base of the pyriform aperture. The periosteum is elevated along the nasofacial groove, the osteotomy is completed, and the bone is outfractured. It is rarely necessary to add a medial osteotomy to avoid an unfavorable fracture of the nasal bone. Percutaneous anteroposterior osteotomy is also seldom necessary.

If the problem is bilateral narrowing due to too much medial transposition of the nasal bone, the osteotomy has to be done bilaterally. However, this is infrequently indicated. This condition can alternatively be corrected with onlay grafts bilaterally. This is highly unpredictable and will not restore the upper lateral cartilage to a normal position, so there is no functional benefit. Osteotomy is often easier to perform in a secondary rhinoplasty patient since ossification is commonly incomplete and there are only fibrous bands that need to be released to reposition the nasal bone. If the problem is too much widening of the nose on one or both sides, it is essential to remove a wedge of bone between the septum and the nasal bone. It is important to complete

the lateral portion of the wedge osteotomy first. Otherwise, if the nasal bone becomes unstable because the medial osteotomy has already been performed, it will be difficult to complete the lateral osteotomy. The mobilized wedge is removed. It is also essential to make sure that this osteotomy is not too superficial and that the removed segment includes the entire thickness of the bone between the nasal bones, to allow repositioning of the lateral segment. Any remaining posterior portion of the nasal bone medially may obstruct repositioning of the bone.

Another common displeasing condition is a step deformity of the lateral nose as a result of a nasal bone osteotomy that is too anterior (low-to-high osteotomy). This leaves a fullness posteriorly and creates a cephalocaudal groove in the midportion of the nasal bone. Often, a posterior low-to-low osteotomy can correct this undesirable groove and reposition the posterior segment to eliminate the step deformity. A small lateral grooving or depression can be corrected with a piece of cartilage or fat graft, as long as it does not interfere with nasal function. The lateral irregularities commonly resulting from an unfavorable fracture of the nasal bone can be eliminated with a rasp.

Correction of Dorsal Deficiency

Dorsal deficiency is a common finding and is a characteristic of rhinoplasties performed three or four decades ago. It is corrected using a piece of precisely carved or diced cartilage graft. The septum, if available, is the preferred graft choice. Especially in patients who have undergone septoplasty, the available cartilage may not be sufficient. However, as mentioned above, a simple history of septoplasty should not dissuade the surgeon from exploring the septum. Usually there is enough cartilage left to overcome minor dorsal deficiencies as a gently crushed cartilage graft or, where the available septal graft is irregular, as diced cartilage (Figure 19.16). To deliver the cartilage graft to this site, the cartilage is diced and packed into a small 0.5 or 1 ml insulin syringe, the

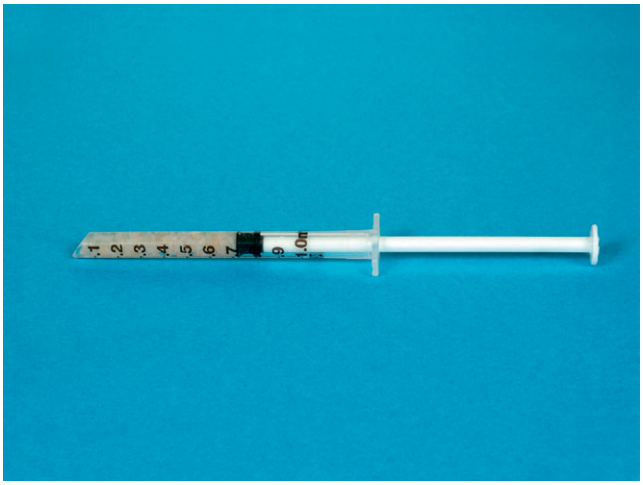


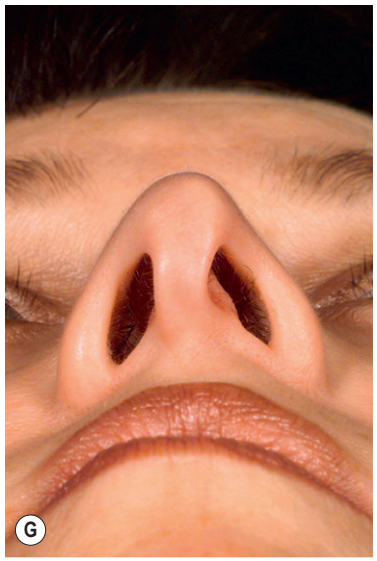
Figure 19.16 Diced cartilage is packed into a 0.5–1.0 ml syringe, with the free end beveled with a saw, and delivered to the pocket.

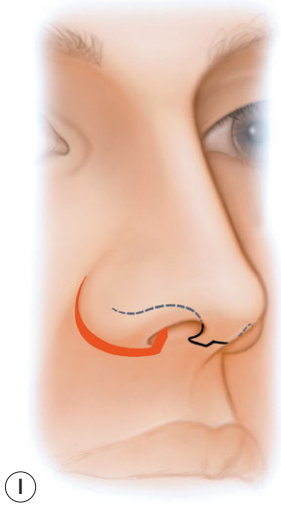
tip of which has been removed with a pair of large scissors or a power saw in a beveled shape. If the pocket is too wide, a tube of temporal fascia is created and filled with the diced cartilage.[15] The graft is then delivered to the site. If a straight piece of cartilage is available, it is gently crushed (Figure 19.17), the margins are beveled and it is then positioned (Figure 19.18; Box 19.1; Animation 19.1). One of the advantages of a gently bruised cartilage graft is that it does not shift easily. However, if there is any question about potential migration of the graft, it should be fixed in position using 6-0 poliglecaprone sutures. It is absolutely crucial to make sure that the dorsum is dissected adequately and symmetrically. Otherwise, an apparently optimally positioned graft can be displaced by the improperly dissected pocket. The graft is carved precisely in such a way that the caudal portion is narrower than the mid- and cephalic portions and all the margins are beveled. Smaller defects can be corrected with conchal cartilage graft (Figures 19.19, 19.20; Box 19.2; Animation 19.2). The perichondrium on one side of the conchal cartilage graft is preserved as it is harvested, the margins are beveled, and the cartilage is gently crushed, if deemed necessary. However, a conchal cartilage graft is not ideal for the dorsum if the defect is medium-sized to large (Figures 19.21–19.23; Boxes 19.3, 19.4; Animation 19.3, Animation 19.4). For medium or large defects of the dorsum, especially when the septum is not sufficient, a costochondral graft would be preferred. The costal cartilage graft is carved in a keel shape, the margins are beveled, and a K wire is passed through the thickness of the graft. A piece of perichondrium or dermis is draped over the graft for patients with thin skin. The perichondrium or the dermis graft is sutured to the cartilage and inserted in place. Additionally, if a columella strut is necessary and a septal cartilage graft is not available, a costal cartilage graft is preferred because it has the proper strength to support the tip.

Animation 19.1 • 19.2 • 19.3 • 19.4

Figure 19.17 A piece of septal cartilage being prepared as a dorsal graft; it is very gently crushed and the margins are beveled.

Figure 19.18 A secondary rhinoplasty patient before (A, C, E, G) and 39 months after dorsal augmentation with septal cartilage graft (B, D, F, H). Illustrations of the surgical maneuvers for soft tissue (I) and frame alterations (J).





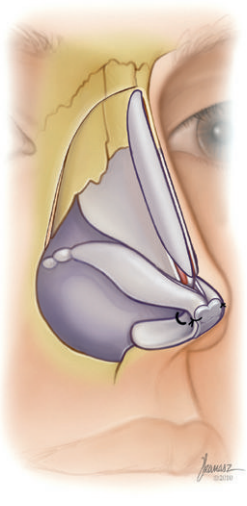


Figure 19.18, cont'd.

BOX 19.1

Surgical Steps: Figure 19.18

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The dorsal hump was removed
- A septoplasty was performed using an open technique
- A bilateral low-to-low osteotomy was carried out
- The medial crura were approximated
- A shield graft was applied
- The caudal septum was resected in a rectangular shape allowing for retraction of the columella
- The redundant membranous septum was removed proportional to the removed caudal septum
- A dorsal graft was applied
- Alar rim grafts were applied
- The alar bases were narrowed with combined excision bilaterally

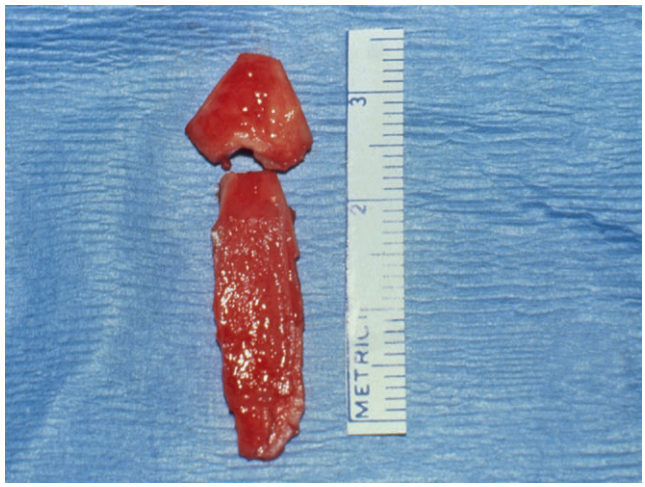


Figure 19.19 A piece of conchal cartilage is harvested to reconstruct a small dorsal defect.

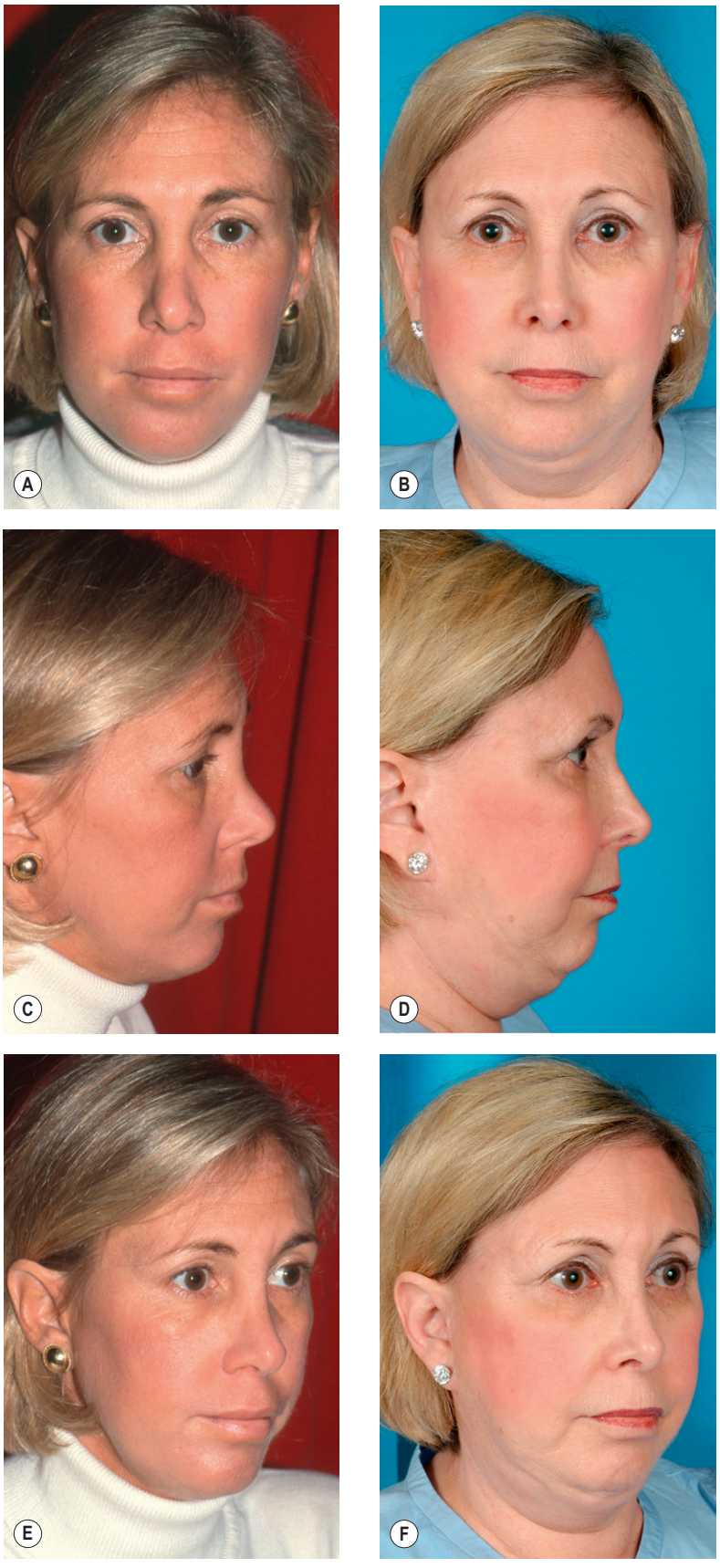
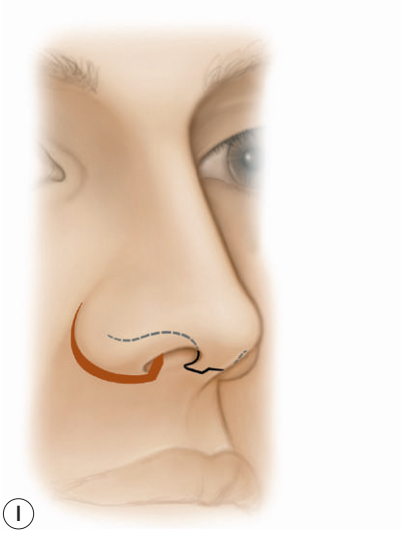


Figure 19.20 Before (A, C, E, G) and 15 years after secondary rhinoplasty with dorsal and tip augmentation using conchal cartilage graft (B, D, F, H). Illustrations of the surgical maneuvers for soft tissue (I) and frame alterations (J).



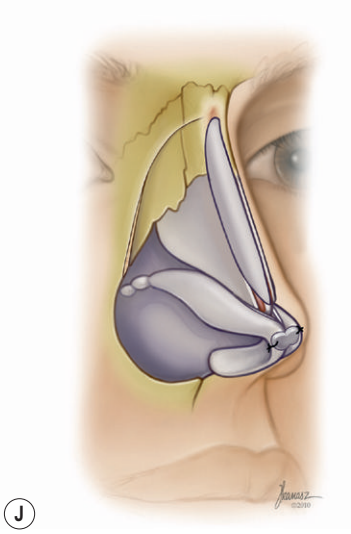


Figure 19.20, cont'd.

BOX 19.2

Surgical Steps: Figure 19.20

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- The nasion was deepened
- A septoplasty was performed using an open technique
- A bilateral conservative inferior turbinectomy was done
- A bilateral low-to-low osteotomy was carried out
- An onlay tip graft was applied
- A dorsal graft was applied
- The alar bases were narrowed with combined excision bilaterally

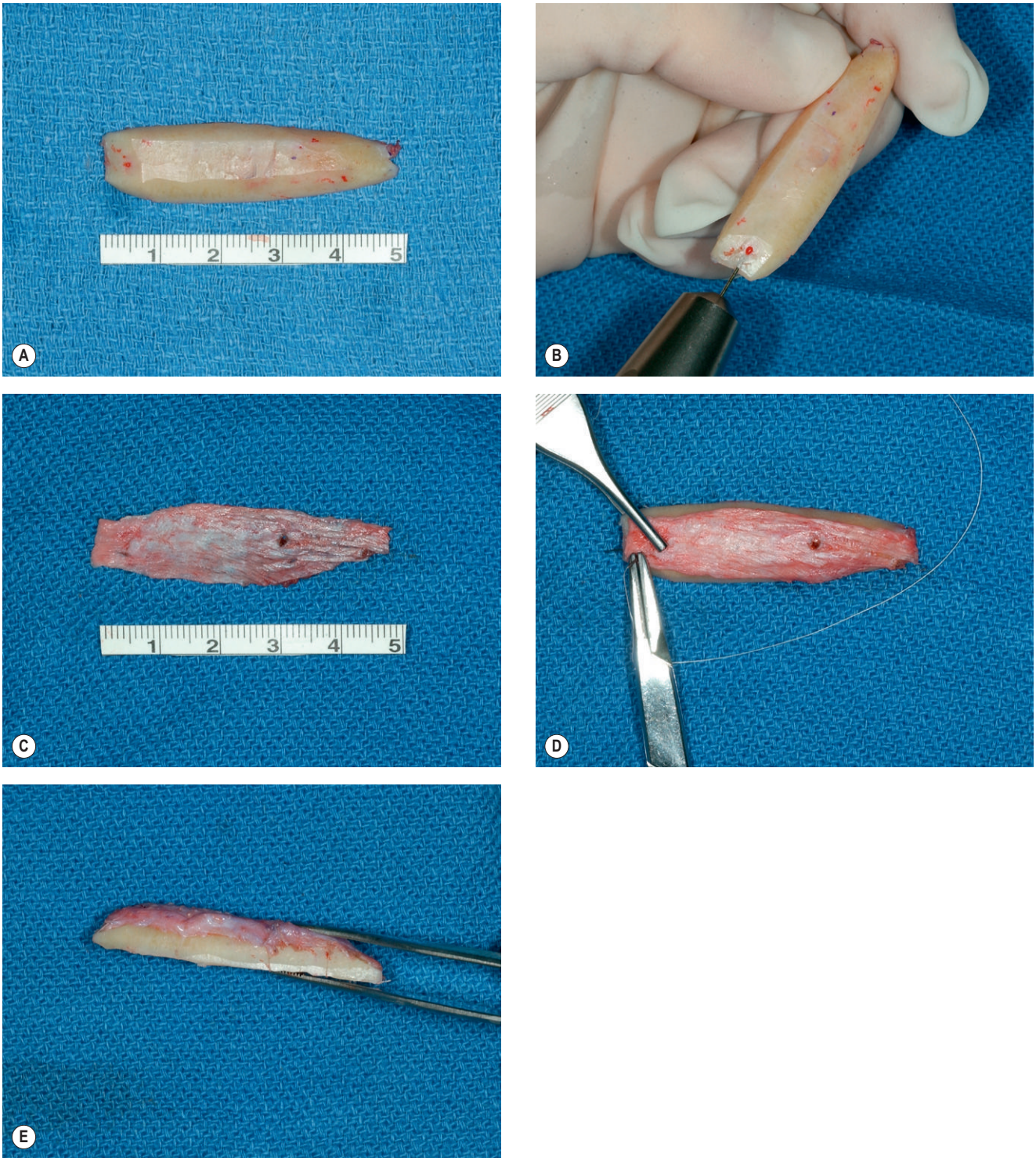


Figure 19.21 (A) The rib cartilage graft is carved in a keel shape and the margins are beveled. (B) A K wire is passed through the thickness of the graft only if warping is observed intraoperatively. (C) In a patient with thin skin, a piece of dermis or perichondrium is draped over the graft. (D) The dermis or perichondrium is sutured to the cartilage. (E) The graft is inserted in place.

Figure 19.22 Before (A, C, E, G) and 19 years after dorsal augmentation using septal and conchal cartilage graft (B, D, F, H) with suboptimal outcome. Illustrations of the surgical maneuvers for soft tissue (I) and frame alterations (J).

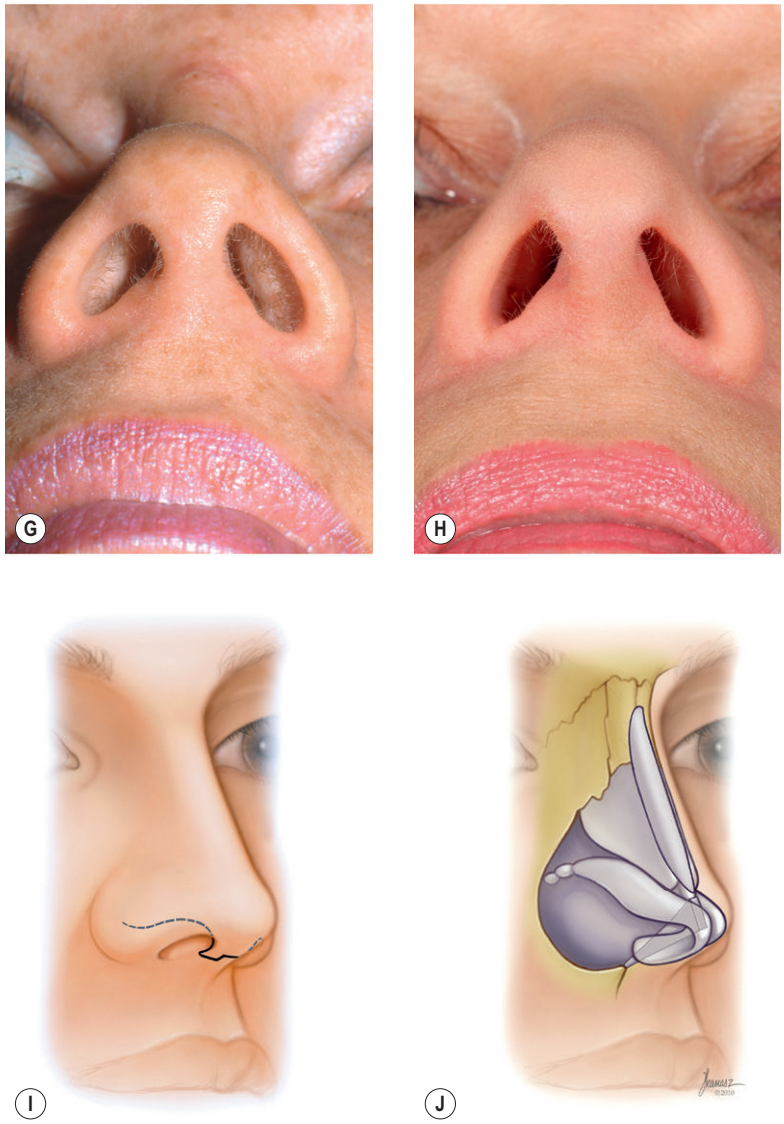


Figure 19.22, cont'd.

BOX 19.3

Surgical Steps: Figure 19.22

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- An extended columella strut was placed to elongate the nose
- A dorsal graft was applied using a combination of septal and conchal cartilages

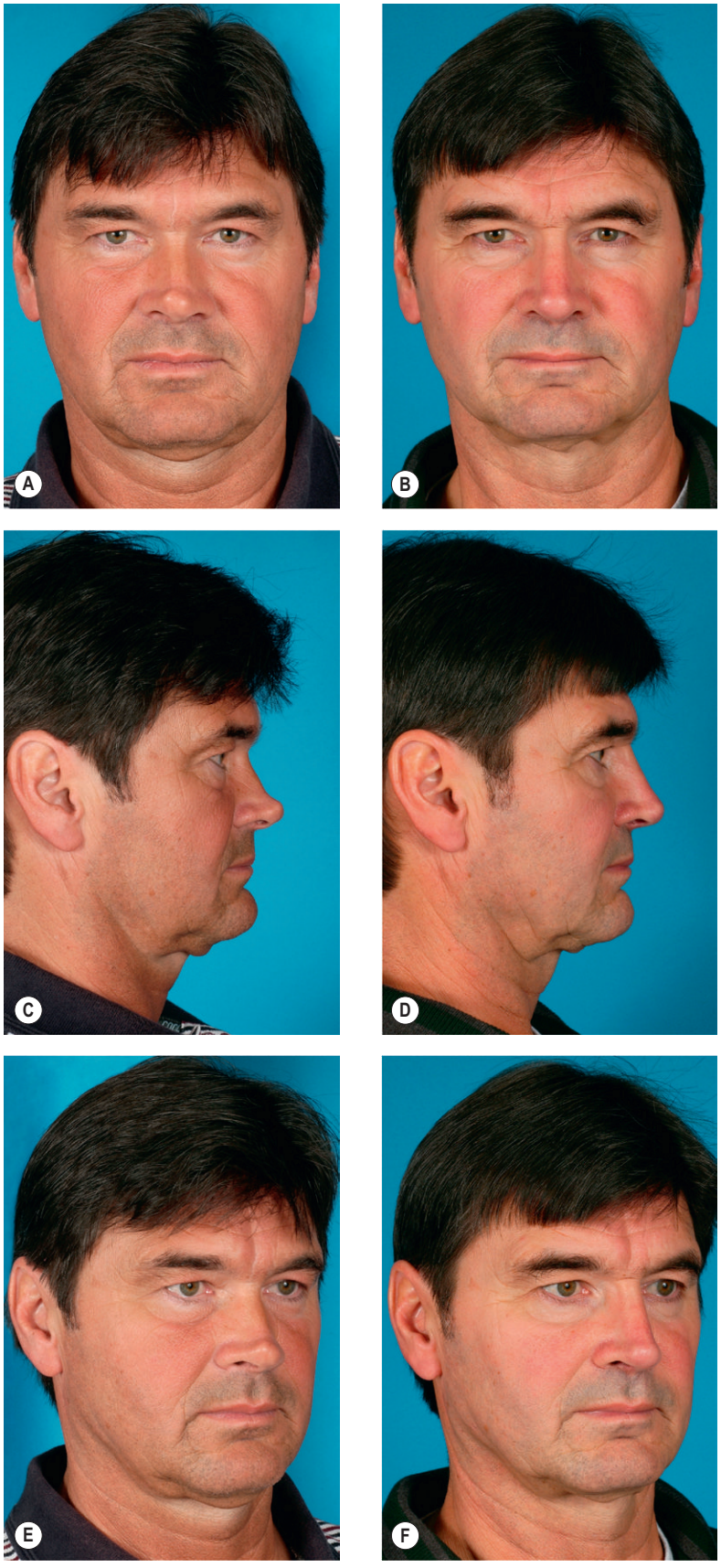
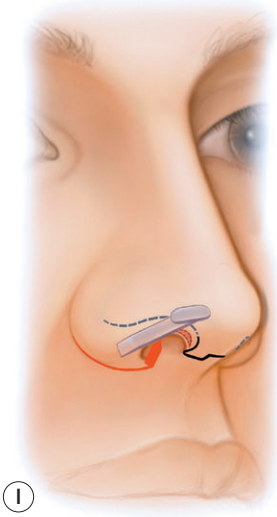


Figure 19.23 Before (A, C, E, G) and almost 3 years after dorsal augmentation with costal cartilage graft (B, D, F, H). Illustrations of the surgical maneuvers for soft tissue (I) and frame alterations (J).



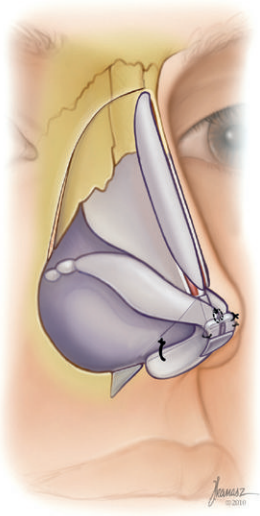


Figure 19.23, cont'd.

BOX 19.4

Surgical Steps: Figure 19.23

- An open technique was used
- A septoplasty was done through an open technique
- A low-to-low osteotomy was done bilaterally
- A columella strut was applied
- A simple interdomal suture was used
- The dome was lowered on the right
- An onlay tip graft was applied
- A subdomal graft was applied
- A nasal spine graft was applied
- A dorsal graft was applied using rib cartilage
- Footplates were approximated
- The caudal borders of the lower lateral cartilages were resected bilaterally
- Alar bases were narrowed with sill excision bilaterally
- Alar rim grafts were applied bilaterally
- A soft triangle graft was applied
- A lobule graft was applied
- The soft triangle lining was removed bilaterally

Harvesting a Conchal Cartilage Graft

First, the ears are examined and the more prominent ear is chosen as the graft donor site. This is discussed with the patient to make sure that it is the patient's preference as well. The ear is infiltrated medially and laterally with xylocaine containing 1:100 000 epinephrine using a 27-gauge needle. The needle may be inserted between the perichondrium and the cartilage to create hydrodissection laterally and facilitate harvesting of the graft. Next, a short 25-gauge needle dipped in brilliant green solution is used to tattoo the incision site in the cartilage within the conchal fossa, across the full thickness of the ear, an adequate amount of cartilage being retained to avoid distortion of the ear. This involves leaving at least 3–4 mm of cartilage medial to the antihelical fold margins within the conchal fossa to support the frame (Figure 19.24A). A postauricular incision is made, guided by the tattoo marks, and the incision is taken down to the cartilage (Figure 19.24B). The perichondrium is left attached to the cartilage medially on the segment to be harvested. The cartilage and the perichondrium within the conchal fossa are separated from the mastoid fascia (Figure 19.24C). The incision is then taken through the perichondrium and the cartilage using a no. 15 blade (Figure 19.24D) and the perichondrium is separated from the conchal cartilage laterally (Figure 19.24E). Once the conchal cartilage has been adequately dissected within the fossa, it is incised circumferentially and removed (Figure 19.24F). Hemostasis is secured. The wound is irrigated copiously with antibiotic solution. A 5-0 plain catgut suture is passed through the skin of the caudal portion of the conchal fossa (Figure 19.24G) and taken through the mastoid fascia caudally (Figure 19.24H), then passed through the mastoid fascia cephalically (Figure 19.24I) and brought back through the skin of the conchal fossa (Figure 19.24J). The suture is temporarily clamped, leaving enough length to tie over the cotton dressing. If the ear is overprojected, a 5-0 PDS mattress suture is used to anchor the conchal cartilage to the mastoid fascia incrementally to match the intact side as measured by a caliper (Figure 19.24K, L). The postauricular incision is then closed using 5-0 plain catgut suture in a running locked fashion (Figure 19.24M). A wet cotton dressing is applied to the conchal fossa and the previously placed 5-0 plain catgut suture is tied over it to eliminate the dead space (Figure 19.24N). The size and shape of the cotton dressing selected are such as not to block the external auditory canal.

Harvesting a Costal Cartilage Graft

To harvest the costal cartilage, a submammary incision is used in a female and an anterior chest wall incision is designed over the sixth or seventh rib in a male patient (Figure 19.25A). The incision is made after injection of the area with xylocaine containing 1:100 000 epinephrine and ropivacaine. The incision is taken through the skin to the underlying rectus muscle using the coagulation power of the cautery, and the muscle fibers are split and retracted. Either the sixth or the seventh rib (Figure 19.25B) is exposed and

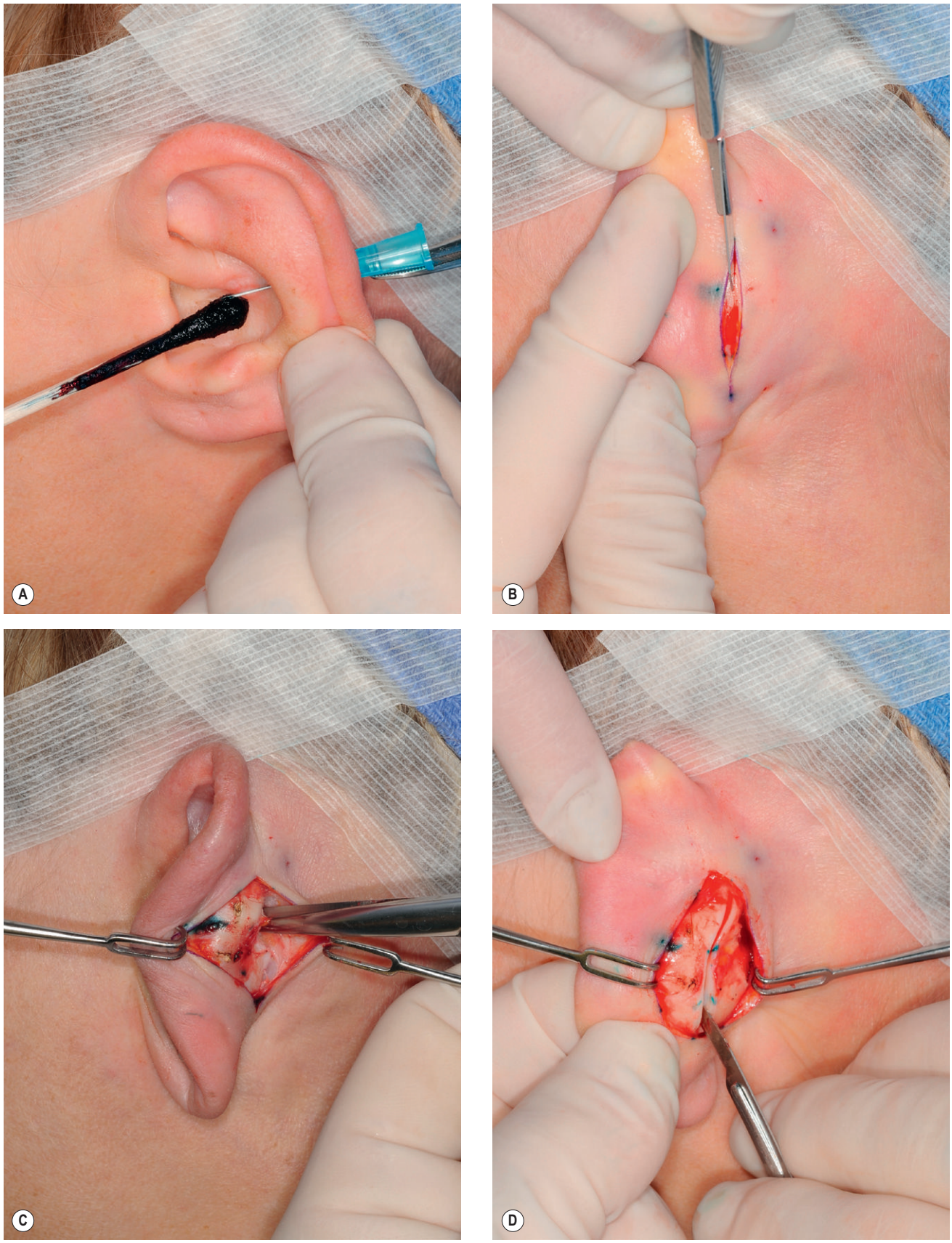


Figure 19.24 (A) A 25-gauge needle and brilliant green solution is used to tattoo the incision site in the cartilage within the conchal fossa, across the full thickness of the ear. (B) A postauricular incision is made, guided by the tattoo marks. (C) The cartilage and the perichondrium within the conchal fossa are separated from the mastoid fascia. (D) The incision is then extended through the perichondrium and the cartilage using a no. 15 blade.

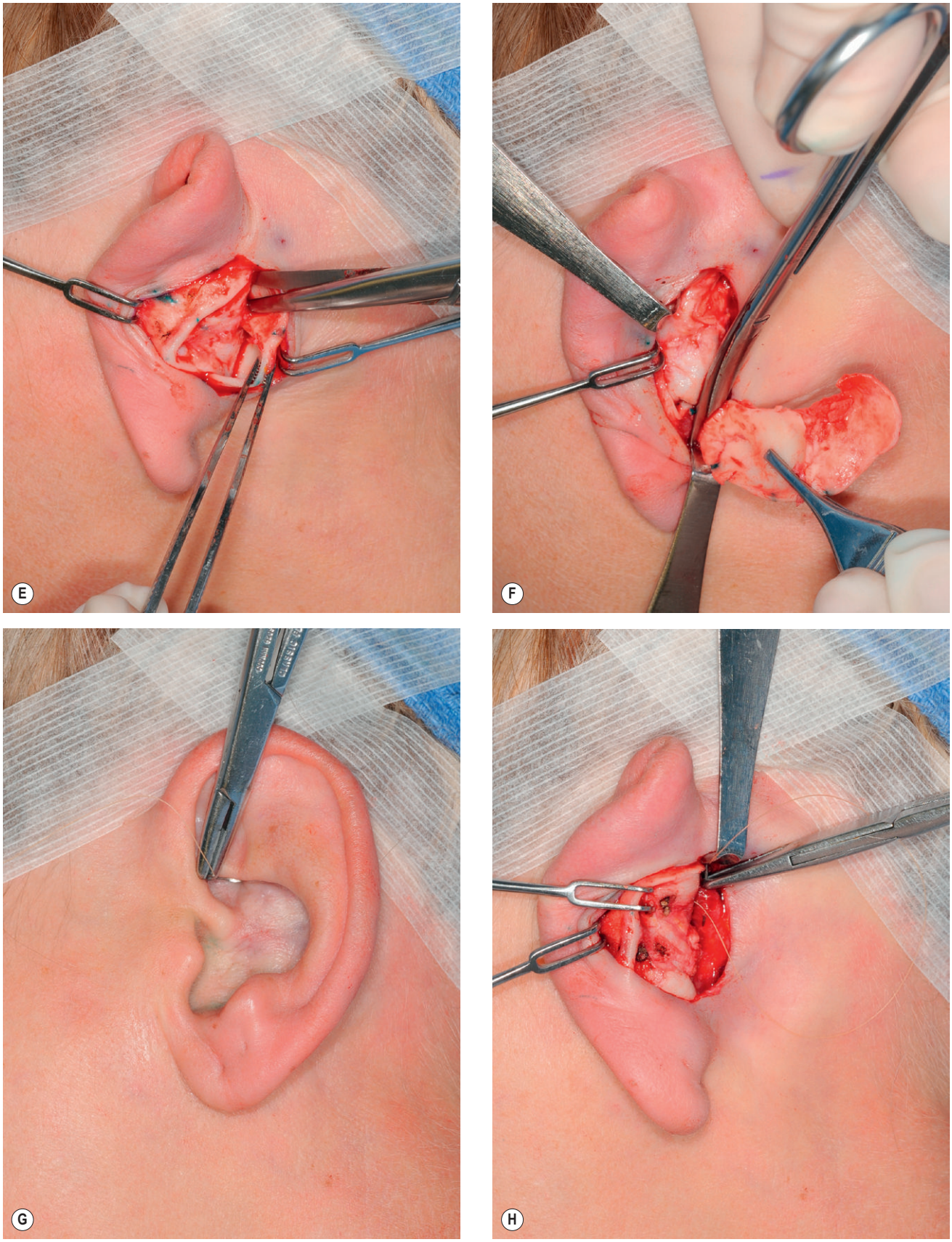


Figure 19.24, cont'd (E) The perichondrium is separated from the conchal cartilage laterally. (F) The conchal cartilage is incised circumferentially and removed once it has been adequately dissected within the fossa. (G) A 5-0 plain catgut suture is passed through the skin of the cephalic portion of the conchal fossa. (H) The suture is taken through the mastoid fascia cephalically.

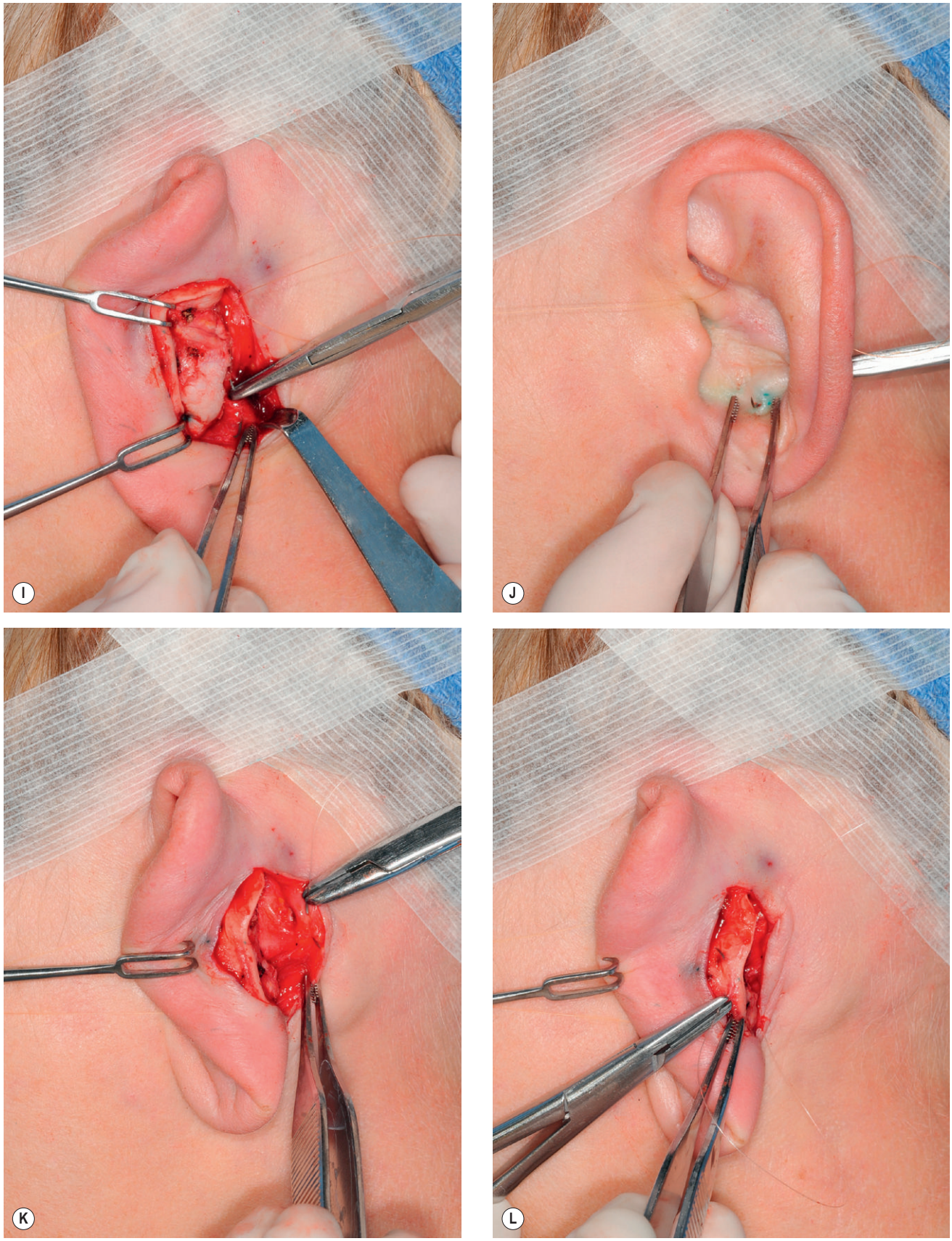


Figure 19.24, cont'd (I) The suture is then passed through the mastoid fascia caudally. (J) The suture is brought back through the skin of the conchal fossa. (K, L) Whenever there is a concern that the ear is overprojected, a 5-0 PDS mattress suture is used to anchor the conchal cartilage to the mastoid fascia incrementally to match the intact site by measurement.

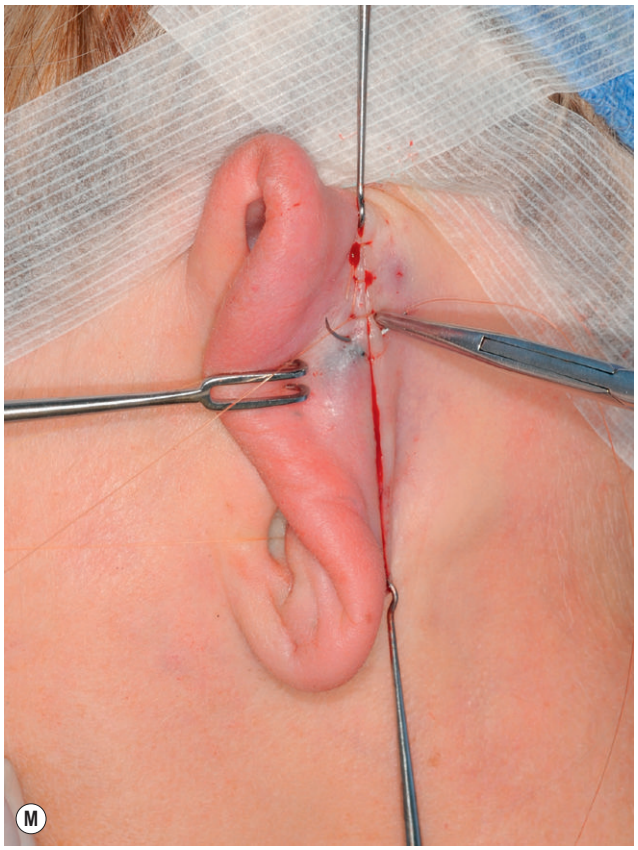


Figure 19.24, cont'd (M) The postauricular incision is then closed using a 5-0 plain catgut suture in a running locked fashion. (N) A wet cotton dressing is applied to the conchal fossa and the previously placed 5-0 plain catgut suture is tied over it to eliminate the dead space.

the costochondral junction is identified. It is easier to start the dissection by elevating the periosteum and continuing through the perichondrium (Figure 19.25C). If the perichondrium is to be used in the graft, the incisions will be along the cephalic and caudal borders of the rib rather than in the center (Figure 19.25D). The posterior perichondrium is left intact and the anterior perichondrium is harvested adequately. Separation of the cartilage from the bone often facilitates safe dissection of the rib from the perichondrium medially. The subperichondrial dissection is continued circumferentially, taking the utmost care to avoid injury to the pleura (Figure 19.25E). Use of the Obwegeser periosteal elevator and malleable retractors can be very helpful here. The cartilage is separated from the sternum with the end of the Obwegeser elevated while the index finger or the malleable retractor protects the posterior perichondrium. A piece of cartilage 5–6 cm long is harvested (Figure 19.25F). A Valsalva maneuver is then carried out to confirm the integrity of the pleura. The wound is further irrigated and a TLS suction drain is placed in position. Meticulous repair is then performed using a combination of 3-0 and 5-0 poliglecaprone for the muscle, fascia, and subcutaneous plane (Figure 19.25G). The skin is repaired using 5-0 plain catgut. A waterproof dressing is applied.

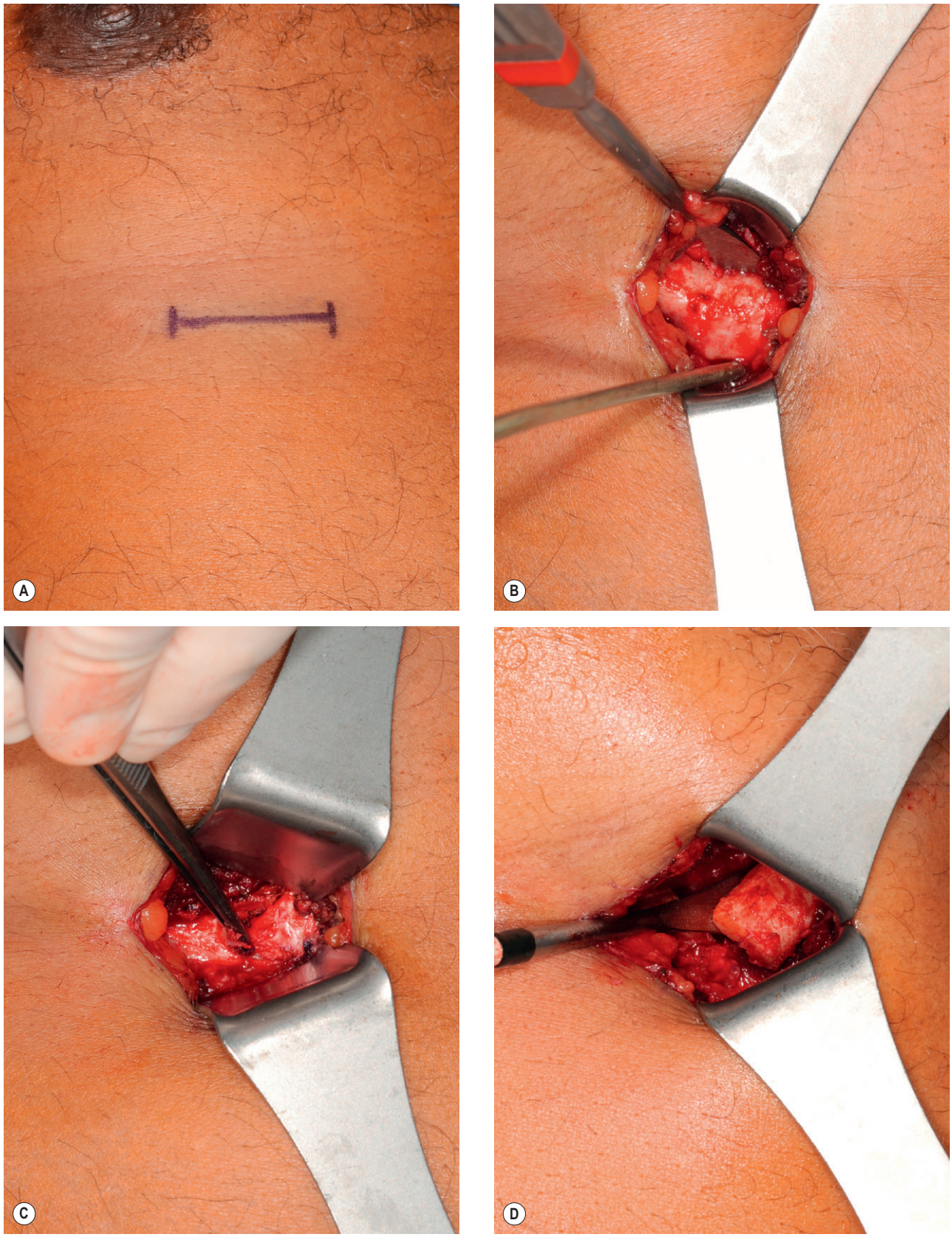
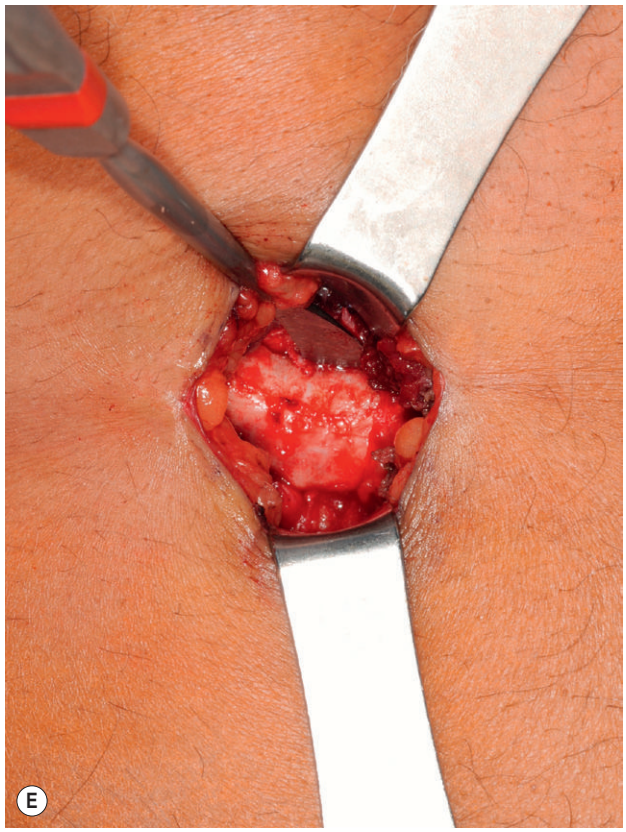


Figure 19.25 (A) To harvest the costal cartilage, a submammary incision is made in a female and an anterior chest wall incision is designed over the sixth or seventh rib in a male patient. (B) Either the sixth or the seventh rib is exposed and the costochondral junction is identified. (C) It is easier to start the dissection by elevating the periosteum and continuing through the perichondrium if the perichondrium is to be used over the graft. (D) If the perichondrium is to be used in the graft, the incisions will be along the cephalic and caudal borders of the rib rather than in the center.



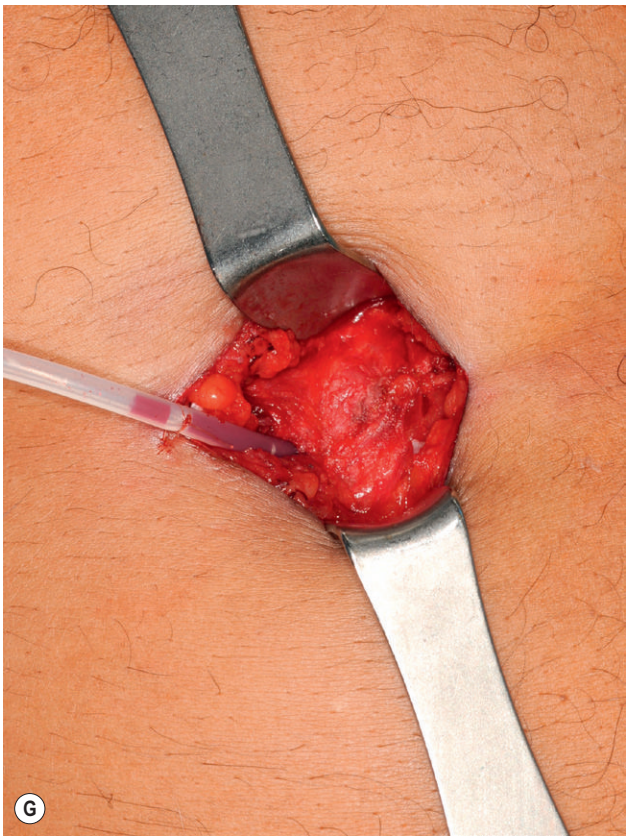


Figure 19.25, cont'd (E) The subperichondrial dissection is continued circumferentially, taking the utmost care to avoid injury to the pleura. (F) A piece of cartilage 5–6 cm long is harvested. (G) Meticulous repair is then performed using a combination of 3-0 and 5-0 poliglecaprone for the muscle, fascia and subcutaneous plane.

An inadvertent perforation of the parietal pleura is inconsequential as long as the visceral pleura is not damaged. A red rubber catheter is introduced in the pleural cavity. The repair is completed as indicated above and the catheter is removed while the lungs are fully expanded by the anesthesiologist.

Correction of an Inverted V Deformity

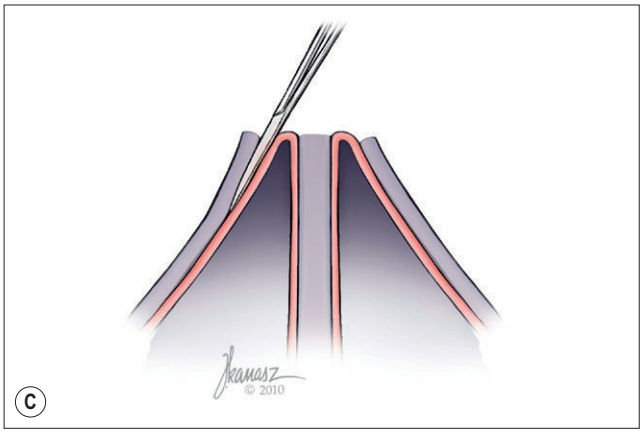
As mentioned above, the inverted V deformity is a consequence of an over-resected dorsum or failure to insert spreader grafts when a large dorsal hump is removed. It results from too much medialization of the upper lateral cartilages even if the nasal bones are still in their proper position. Medial positioning of the upper lateral cartilages inevitably disturbs the function of the internal valve and also results in a break in the continuity of the dorsal lines.[4] Mild to medium deformities can be corrected mainly by placement of spreader grafts, as discussed in Chapter 4. More severe forms of this deformity in someone with deficient or significantly attenuated upper lateral cartilages requires the use of a splay graft.[16]

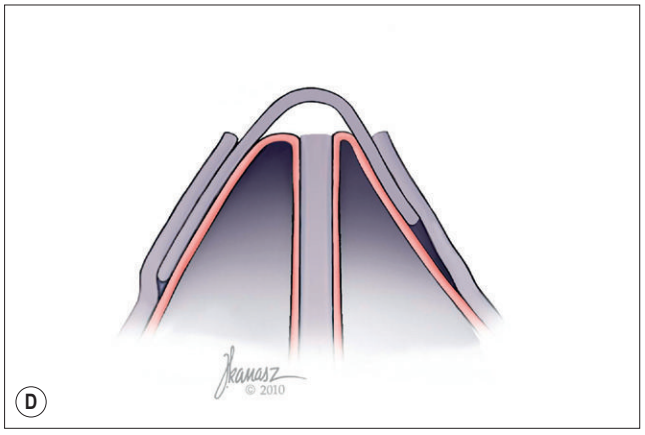
Spreader grafts can be placed using either a closed or open technique. To perform this operation properly using a closed technique, the dorsal lining is injected with xylocaine containing 1 : 100 000 epinephrine. A small (3–4 mm) anteroposterior incision is made on the dorsal side of the mucoperichondrium directly caudal to the intercartilagenous junction. The septal elevator is then inserted between the mucoperichondrium and the dorsal septum while the index finger of the nondominant hand monitors the position of the septal elevator. The subperichondrial dissection is continued slightly cephalad to the nasal bones, essentially creating a tunnel that extends from the caudal end of the upper lateral cartilages to underneath the nasal bones. At this point, the spreader grafts are prepared. Notwithstanding the open or closed nature of the approach, the spreader graft will extend from a point slightly cephalad to the caudal end of the nasal bones to the caudal end of the upper lateral cartilages. This usually requires a graft with a length of 15–18 mm, although sometimes it is shorter or longer. If elongation of the nose is part of the plan the spreader grafts will extend beyond the anterocaudal septum. In the closed technique, the cartilage is introduced into the space and advanced cephalically, being monitored percutaneously with the nondominant index finger. This can be done unilaterally or bilaterally and the grafts can consist of a single or double layer depending on the magnitude of the deficiency. When the open technique is used, the mucoperichondrium is separated from the septum, and the spreader graft is placed in position precisely and fixed using horizontal mattress sutures in at least two places. The ends of the spreader grafts are beveled prior to insertion to avoid visibility and any step deformity. The lower lateral cartilages are then approximated to the spreader grafts using 5-0 PDS (see Videos 4.19a and 4.19b from Chapter 4).

Spreader grafts have more significance for the aesthetics of the dorsal lines than for improvement of internal valve function.

Splay Graft

A splay graft is utilized when the lower lateral cartilages are significantly deficient or too attenuated. To place the splay graft, the extent of the defect is first marked on the skin (Figure 19.26A). Conchal cartilage is often a





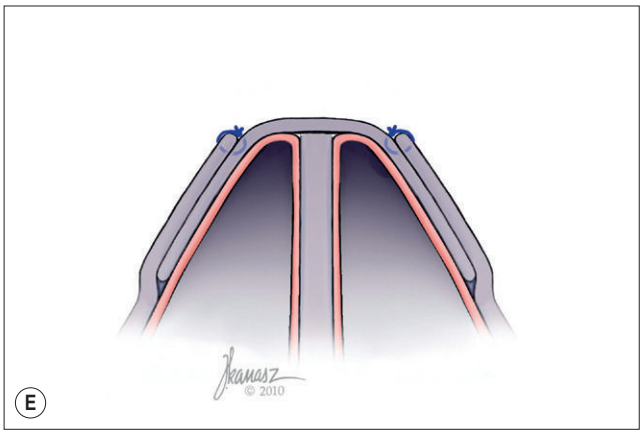


Figure 19.26 (A) The extent of the defect is measured and marked on the skin. (B) A piece of conchal cartilage matching the defect is prepared to extend from one pyriform aperture. (C) The perichondrium is dissected off the upper lateral cartilage bilaterally. (D) The graft is inserted into position. (E) The upper lateral cartilages are sutured tightly to the graft.

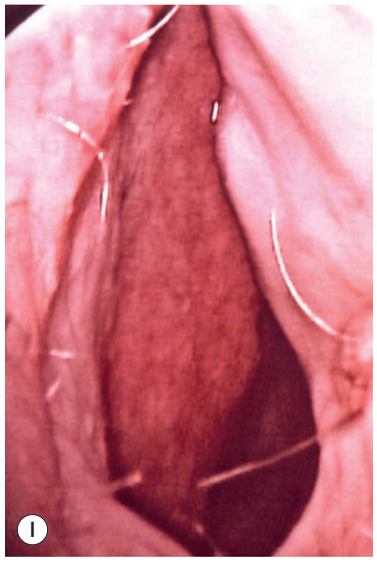
suitable source for a splay graft. The superficial portion of a costal cartilage graft might also be suitable. The graft is tailored to a length sufficient to extend from one pyriform aperture to the other, extending over the dorsum and beneath the upper lateral cartilage (Figure 19.26B).[16] The width of the graft is dictated by the width of the defect marked on the skin. This surgery is commonly carried out using an open technique. Hydrodissection by injection of xylocaine containing 1 : 100 000 epinephrine may facilitate the process. A pair of iris scissors is used to start the dissection. The mucoperichondrium is separated from the medial surface of the upper lateral cartilage (Figure 19.26C). The dissection is continued down to the pyriform aperture bilaterally. Before the graft is inserted in position the dorsum is checked. If there is a pre-existing dorsal defect, as is commonly the case, the thickness of the graft may eliminate the deficiency and create an optimal dorsal profile. Otherwise, the dorsum is lowered sufficiently to accommodate the thickness of the graft and to create a smooth dorsal profile. The graft is inserted in position on one side over the pyriform aperture and spanned over the dorsum, extending to the other pyriform aperture (Figure 19.26D). The graft is sutured to the underlying septum using 5-0 or 6-0 PDS. The upper lateral cartilages are then draped tightly over the graft, extended anteriorly, and sutured to the graft tightly to strengthen the cartilage and offer better resistance when there is negative pressure in the nasal cavity (Figure 19.26E; Animation 19.5). Septal cartilage can be used for this purpose (Figure 19.27; Box 19.5; Animation 19.6). However often it needs to be bruised gently to avoid too much widening of the nose.

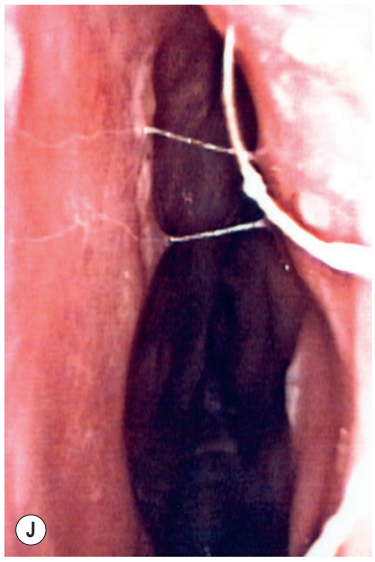
Animation 19.5 • 19.6

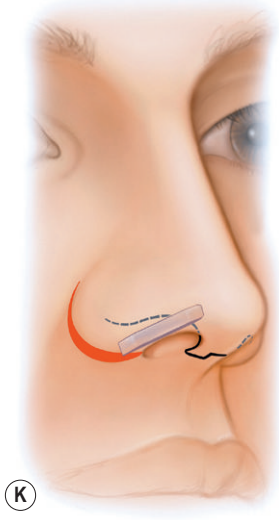
Adjustment of the Caudal Dorsum

Excessive projection of the caudal dorsum may result in supratip deformity and deficiency in this site will cause too much supratip break. The solution for overprojection is a great deal easier: contouring the caudal dorsum can be accomplished simply by removal of the excess portion of the anterocaudal septum. The excess amount is judged visually and by palpating several times with the skin draped in position. While a differential level of 6–8 mm is considered optimal in most cases for a primary rhinoplasty, in secondary rhinoplasties the differential level does not usually exceed 3–4 mm. Occasionally, the supratip fullness is the result of scar tissue, which is removed. Placement of a supratip stitch (see Video 4.24a and 4.24b from Chapter 4; Figure 16.6 from Chapter 16) is advisable in all patients with supratip deformity unless the skin in this zone is very thin. If there is a cartilage frame deficiency in conjunction with the supratip deformity (due to previous over-resection of the caudal dorsum), the scar tissue is removed and the dorsal frame deficiency is corrected by application of a cartilage graft, which is fixed in position and the skin is approximated to the underlying cartilage to eliminate the dead space using the supratip suture described in Chapter 4.

Figure 19.27 A patient before (A, C, E, G) and 2 years after insertion of a splay graft (B, D, F, H). The intranasal views demonstrate the opening of the internal valve (I, J). Illustrations of the surgical maneuvers for soft tissue (K) and frame alterations (L).







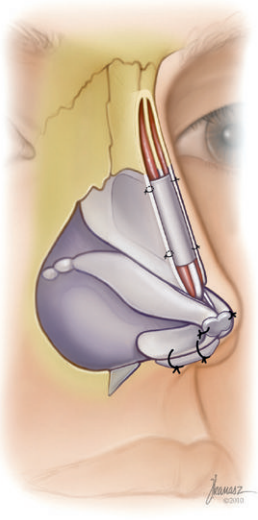


Figure 19.27, cont'd.

BOX 19.5

Surgical Steps: Figure 19.27

- An open technique was used
- The cephalic portion of the lower lateral cartilages was removed
- A septoplasty was performed using an open technique
- A splay graft was applied using conchal cartilage
- An onlay tip graft was applied
- A nasal spine graft was applied
- Synechiae were released conservatively using electrocautery
- The alar base was narrowed with lateral excision bilaterally
- Alar rim grafts were applied bilaterally
- A columella onlay graft was applied

Placement of a Columella Strut

As discussed in Chapter 3, a columella strut is used when the columella is short. This will provide stability to the central portion of the nasal tripod. It is crucial to understand that placement of a columella strut results in cephalic rotation of the tip, as well as more protrusion of the columella and subnasale. A piece of cartilage about 20–30 mm long, depending on the intended goals, and 3 mm wide is harvested from the septum. The graft is then placed between the medial crura over the nasal spine and fixed in position symmetrically while observing the results three-dimensionally. The technique of placement of a columella strut is described in Chapter 4. The only difference in a secondary rhinoplasty is that scar tissue is often present, rendering dissection somewhat more difficult. It is also not uncommon to find a previously inserted columella strut that is either too short or too thick. This is removed and replaced with one that is a proper size and shape. Tattooing or placement of two or three 25-gauge needles across the medial crura and the columella strut, as described for primary rhinoplasty in Chapter 4, will ensure symmetric positioning of both. A 5-0 PDS suture is used to fix the columella strut to the medial crura.

Tip Graft

If the inadequate tip projection is related to insufficient lobule volume, a tip graft can be applied. An onlay or shield graft is selected depending on whether there is any need for augmentation of the infratip tip lobule. A shield graft elongates the nose in addition to adding projection. Therefore, it can only be used in a patient who has a short nose with ideally positioned alar rims and deficient length centrally.

A tip graft can be placed using a closed or open technique. To place the tip graft using a closed technique, first identify the midline of the tip and mark the ideal position of the tip highlights (Figure 19.28A). The graft is harvested using the tip punch devices described in previous chapters. If a septal cartilage graft is to be used, the margins should be beveled to minimize visibility. The graft is then moistened minimally and placed on the tip to transfer an imprint of the marks from the tip to the graft (Figure 19.28B). The markings will serve as a precise guide for placement of the sutures (Figure 19.28C). Next, a rim incision is made (by a right-handed surgeon) in the patient's right nostril (Figure 19.28D) and the tip is skeletonized using a pair of baby Metzenbaum scissors (Figure 19.28E), care being taken to ensure that the pocket is sufficient and symmetrical. A double-armed suture is then passed through the graft (Figure 19.28F). A small Crile retractor is placed in position and, using this retractor as a guide, the needle that has been passed through the graft is passed through the marking on the left side of the tip (Figure 19.28G). Then the Crile retractor is repositioned on the right side and the second needle is passed through the marking on the right side of the tip (Figure 19.28H). Maintaining the orientation of the graft, while the suture is pulled anteriorly (Figure 19.28I), the graft is then delivered into position. The graft can be predictably positioned symmetrically according the plan (Figure 19.28J).

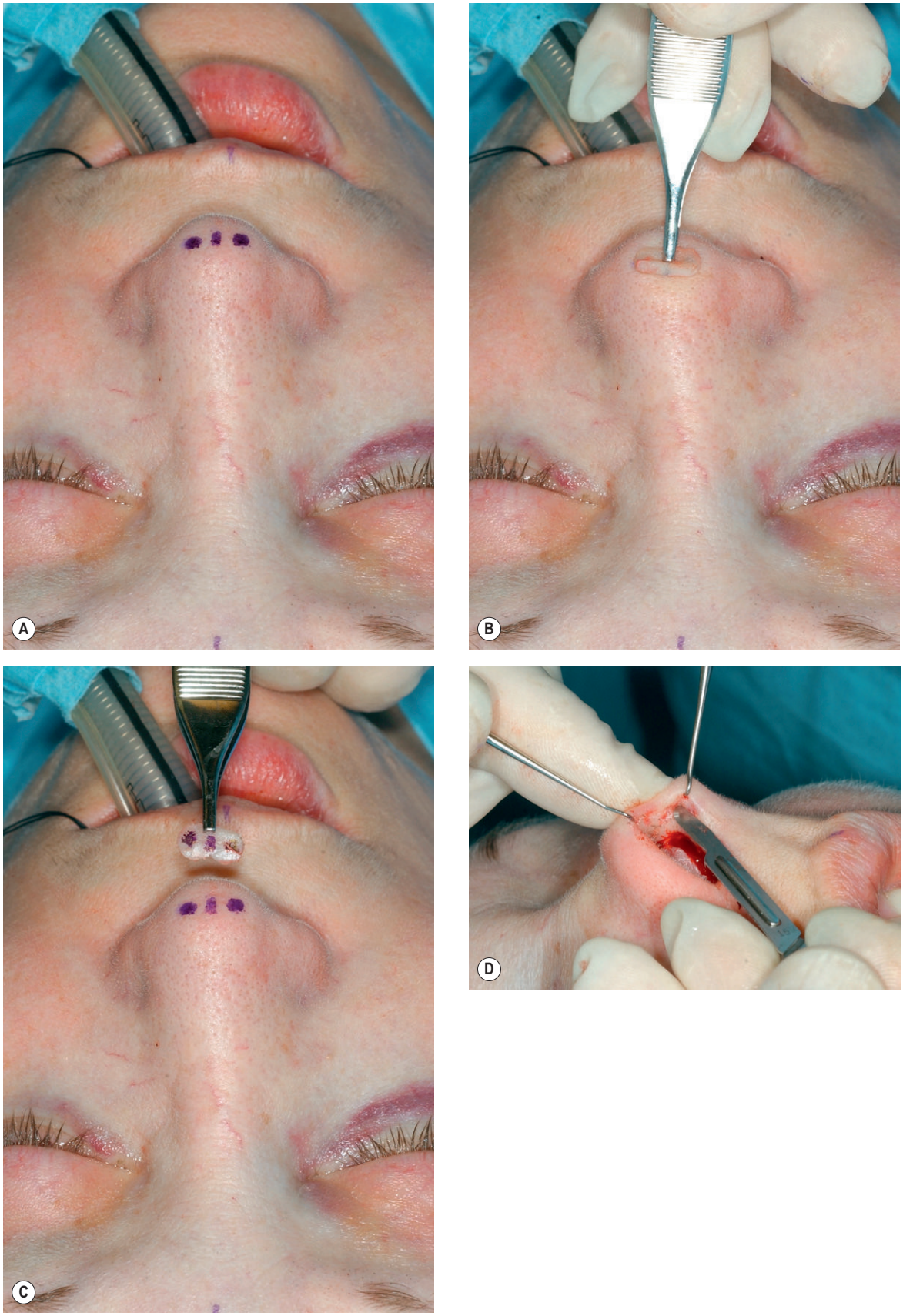
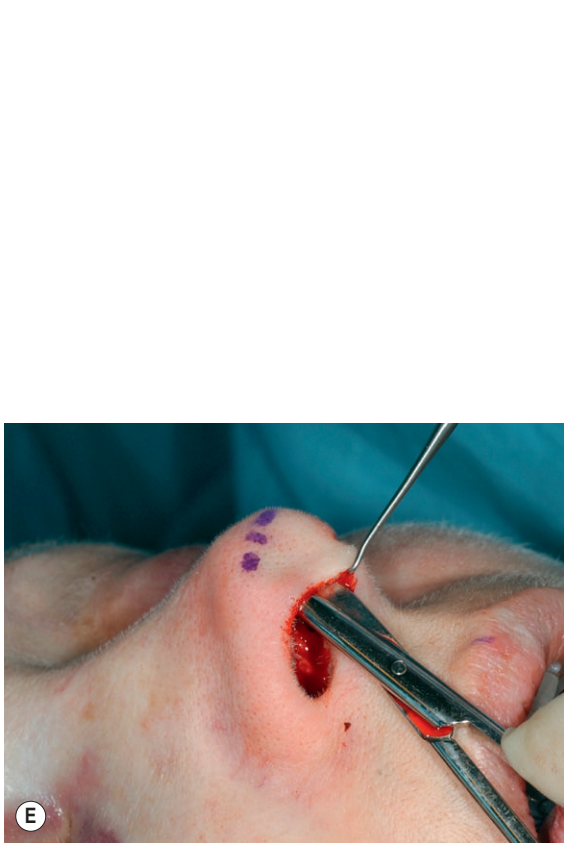
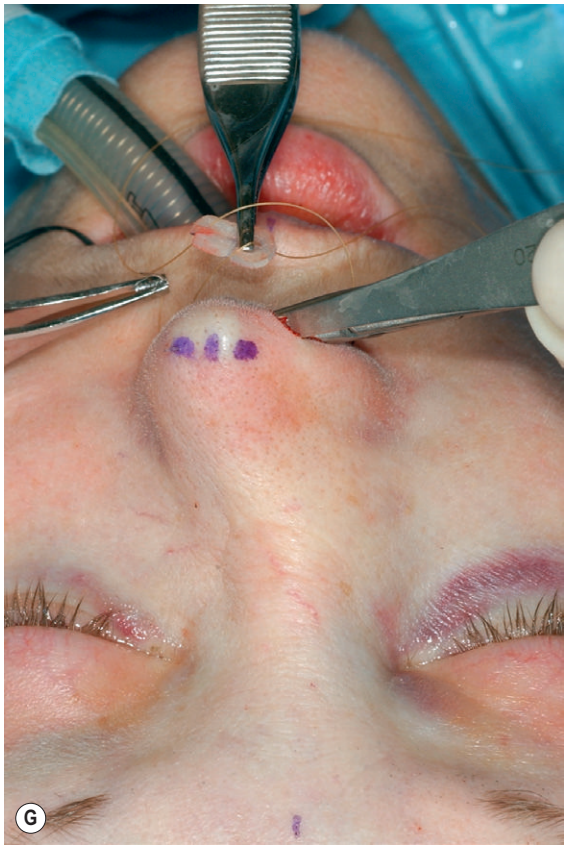


Figure 19.28 (A) The midline of the tip is indentified and the ideal position of the tip highlights is marked. (B) The graft is then moistened minimally and placed on the tip to transfer the marks on the tip of the nose to the graft. (C) The markings will serve as a precise guide for placement of the suture. (D) Next, a rim incision is made.





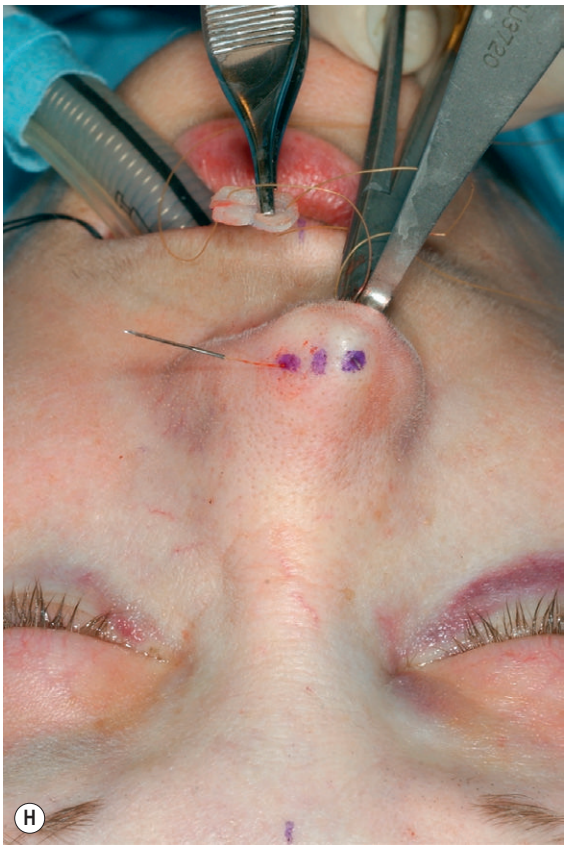


Figure 19.28, cont'd (E) The tip is undermined using a pair of baby Metzenbaum scissors. (F) A double-armed suture is then passed through the graft. (G) A small Crile retractor is placed in position and, using this as a guide, the needle that has been passed through the graft is passed through the marking on the left side of the tip. (H) The second needle is passed through the right side while the first needle is partially passed through the skin on the left side.

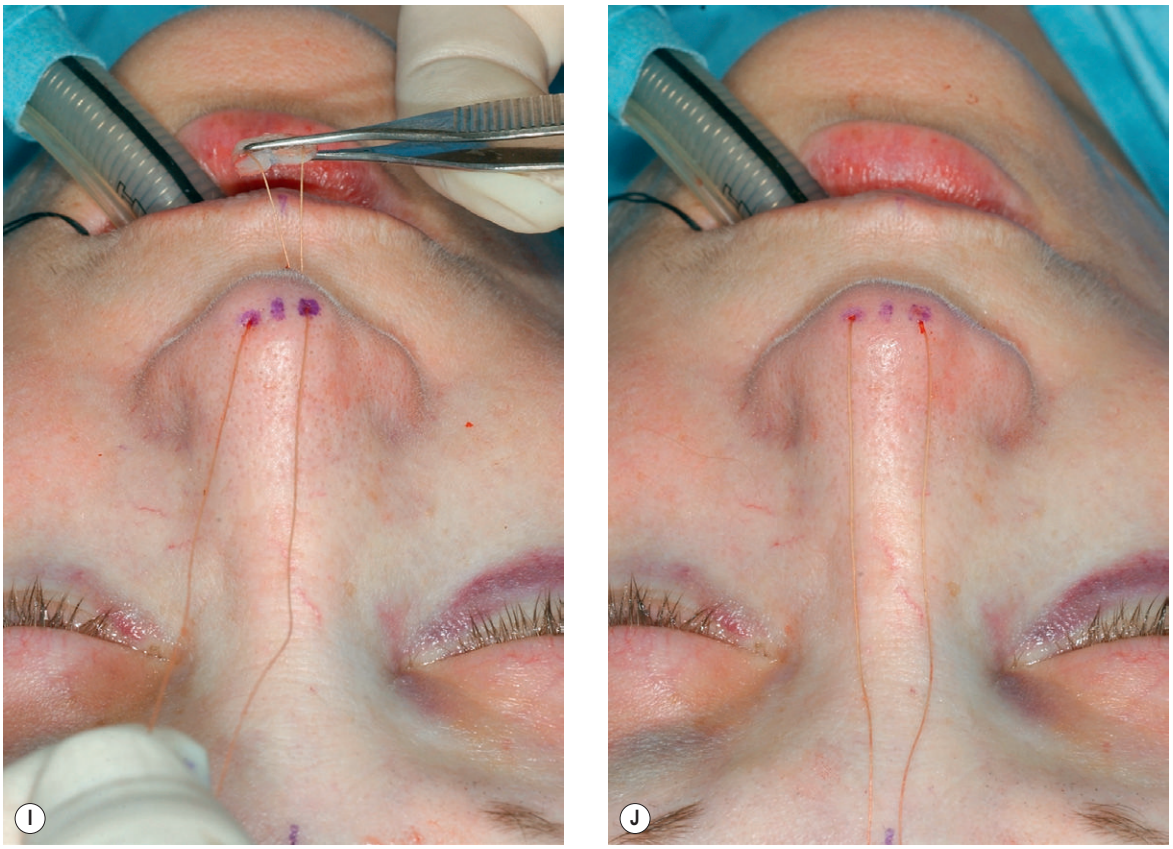


Figure 19.28, cont'd (I) Maintaining the orientation of the graft, it is delivered under the skin of the tip through the nostril incision by pulling gently on the suture. (J) The graft is delivered into position with the utmost precision.

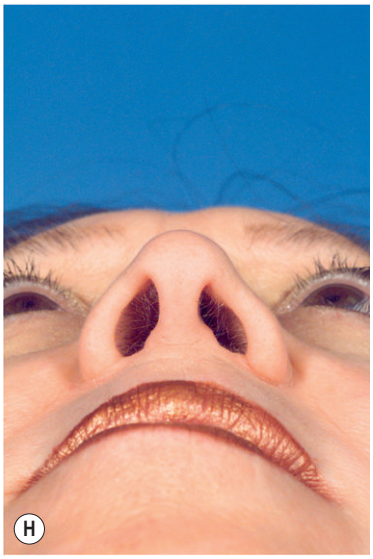
If an open technique is used, the graft is sutured in position using 6-0 polyglactin and monitored three-dimensionally as previously described. It is crucial to observe the graft position from the caudal, lateral, and cephalic views (Figure 19.29; Box 19.6; Animation 19.7).

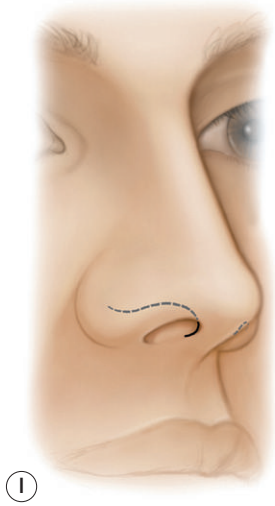
Animation 19.7 •

Footplates

The footplates of the medial crura are commonly splayed and may also be asymmetrical. They are exposed through a 5 mm transfixion incision, are dissected, and, if necessary, the redundant portion is resected. Otherwise, the footplates are approximated in the following manner. A pair of iris scissors is used to connect the right and the left short transfixion incisions. The footplates are then exposed beyond the removed portion. A 5-0 PDS suture is passed through one footplate. The needle is then delivered to the opposite side, passed through the opposite footplate, retrieved through the initial site, and tied incrementally in a similar way to that described for primary rhinoplasty (see Video 4.22a, b from Chapter 4). This will approximate the footplates, advance the columella caudally, and provide more tip support. If it is

Figure 19.29 A patient before (A, C, E, G) and 16 years after placement of a tip graft (B, D, F, H). Illustrations of the surgical maneuvers for soft tissue (I) and frame alterations (J).





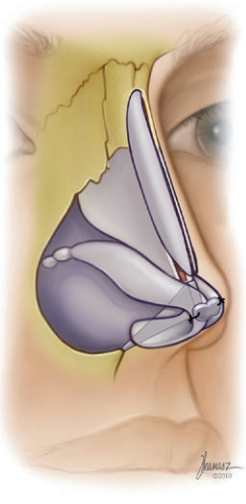


Figure 19.29, cont'd.

BOX 19.6

Surgical Steps: Figure 19.29

- A closed technique was used
- A small dorsal hump was removed
- A septoplasty was performed using an open technique
- Bilateral spreader grafts were applied
- A columella strut was applied
- An onlay tip graft was applied
- A dorsal graft was applied

necessary to avoid fullness in the subnasale, the excess soft tissue between the footplates is resected along with the cephalic portion of the footplate. The footplates are then approximated.

Correction of Retracted Alar Rim

If the alar rim is minimally retracted, this can be corrected by placing an alar rim graft (see Chapter 11). This also eliminates concavity of the lower lateral cartilage.[17] A piece of septal, conchal, costal, or cephalic margin of the lower lateral cartilage is carved 2–3 mm wide and 12–15 mm long. A pocket is created along the alar rim through an anterior incision or through the rim portion of the open technique incision. The graft is placed as close to the alar margin as possible. A 6-0 fast absorbable catgut suture is used to fix the graft in position (see Video 4.25a, b from Chapter 4).

However, if the alar retraction is significant, a composite graft or V–Y advancement is a better choice. It is crucial to have this in the plan prior to making the open rhinoplasty incision. Rather than the incision being at the alar rim or along the caudal margin of the lower lateral cartilage, the incision will then be V-shaped, extending towards the intercartilagenous junction (see Chapter 11). Presence of a previous rim incision does not preclude a V–Y advancement.

Alar Base Abnormalities

Alar base abnormalities have already been discussed and are extremely common in secondary rhinoplasty patients (see Chapter 12). When narrowing the alar base as a secondary procedure, one must exercise caution, since the response rate to the removal of soft tissues is greater if the alar base has already been narrowed. Essentially, in a secondary alar base reduction, the response rate is 1:1.

Adjustment of the Nostril Shape

Ideally, the nostrils are oval and oriented slightly medially as they extend anteriorly. Displeasing nostrils may be round or even oriented horizontally. Their shape can be changed using a variety of techniques as described in Chapter 13.[18] The components that contribute to the shape of the nostrils include the width of the columella, the position of the footplates, redundant soft triangle lining, and the shape and direction of the lateral crura of the lower lateral cartilages. By adjusting these structures, one can control the shape of the nostrils. A nostril can be elongated by using a combination of a columella strut, approximation of the footplates, removal of a crescent piece of the soft triangle lining where there is a redundant amount of skin between the anterior portion of the nostril and the dome, and application of an alar rim graft. The presence of scar tissue from the previous surgery may limit the success of nostril size alteration.

Postoperative Care

If an osteotomy has not been part of the procedure, a splint can be avoided and SteriStrips will be sufficient. If SteriStrips™ are used, they are only kept in position for 3–4 days except in patients with thick skin or those who had a supratip deformity. In such cases, the tip and supratip strips are applied in the evening for several weeks. However, osteotomy requires the use of a dorsal splint, which is usually kept in place for 7–8 days. Doyle stents are commonly used if a septoplasty is being performed for the first time. They are not necessary for most secondary septoplasties.

Secondary Turbinectomy, Septoplasty, and Dealing with a Septal Perforation

Many secondary rhinoplasty patients require reassessment of the septum and turbinates and possible turbinectomy and septoplasty for either recurrent or residual deviation and/or airway compromise. Synechiae should be noted and eliminated if they exist. Electrocautery is used mainly to cauterize the synechiae close to the lateral structure to minimize the potential for perforation of the septum resulting from thermal damage.

Perforations smaller than 2 cm are repaired in the following manner (Figure 19.30A). An incision is made in the membranous septum and a pocket is created past the perforation site by separating the mucoperichondrium on either side (Figure 19.30B). A straight piece of septal or conchal cartilage is then advanced in position (Figure 19.30C) and simple stents are applied to either side to maintain the cartilage in position and aid re-epithelialization (Figure 19.30D). Perforations as large as 1 cm can be very predictably corrected with this technique and usually heal within 2–3 weeks. Even perforations up to 1.5 cm and sometimes up to 2.0 cm can be treated in this manner. Larger perforations will require additional maneuvers, including the use of mucosal flaps and an interposition graft. An extensive perforation should be left alone and heroic measures undertaken in an attempt to repair it may cause more damage than benefit to the patient.

Many secondary rhinoplasty patients who have had partial turbinectomy involving the anterior portion of the turbinate have compensatory enlargement of the posterior portion. Such patients benefit from conservative posterior turbinectomy and cauterization of the remaining normal-sized turbinate. It is essential to remove only the enlarged posterior portion and not the entire turbinate. This observation provides additional evidence that removal of the anterior or posterior portion of the turbinate only is ill advised. The turbinate should be trimmed evenly across its full width unless hypertrophy is localized.

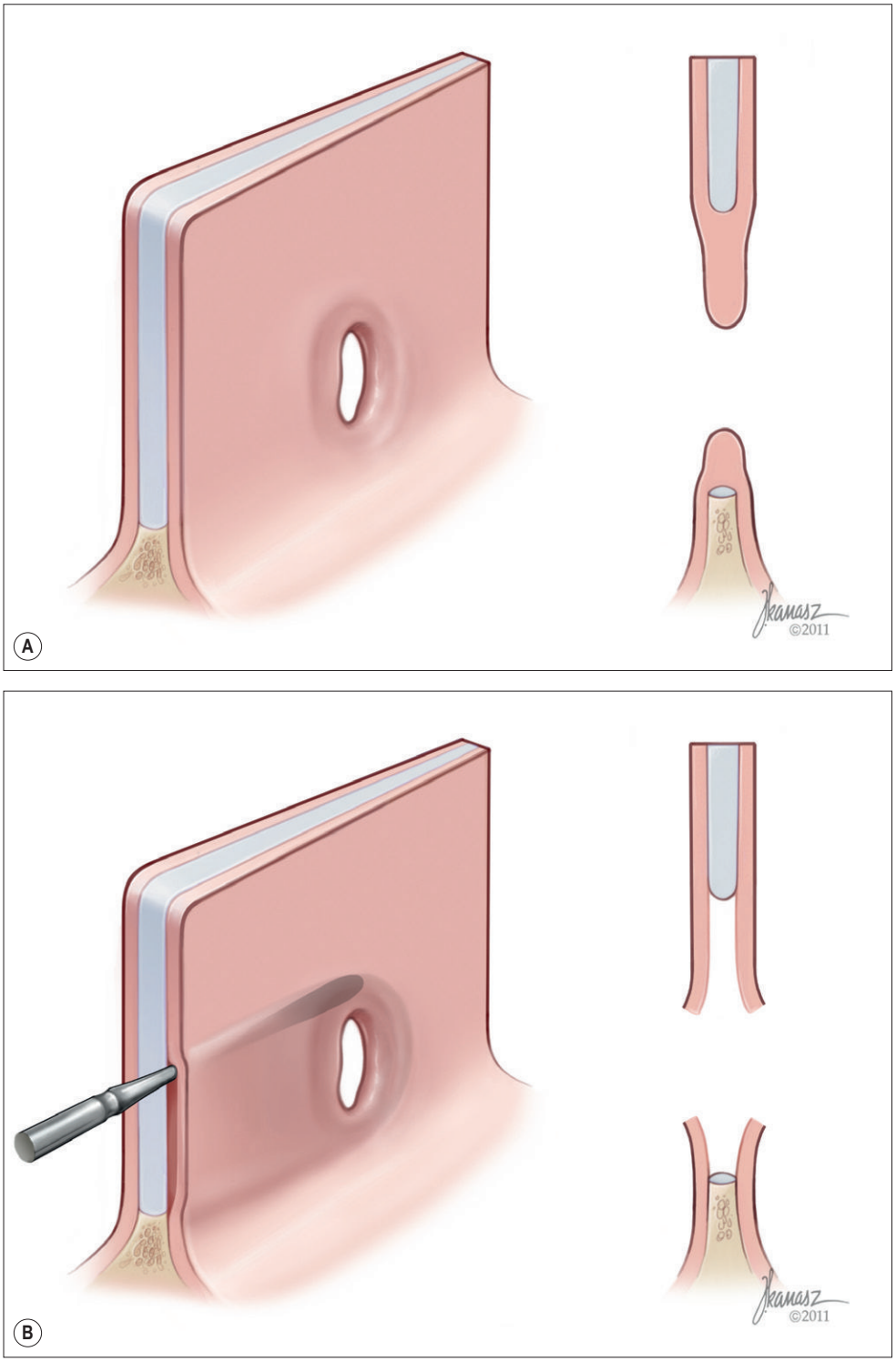
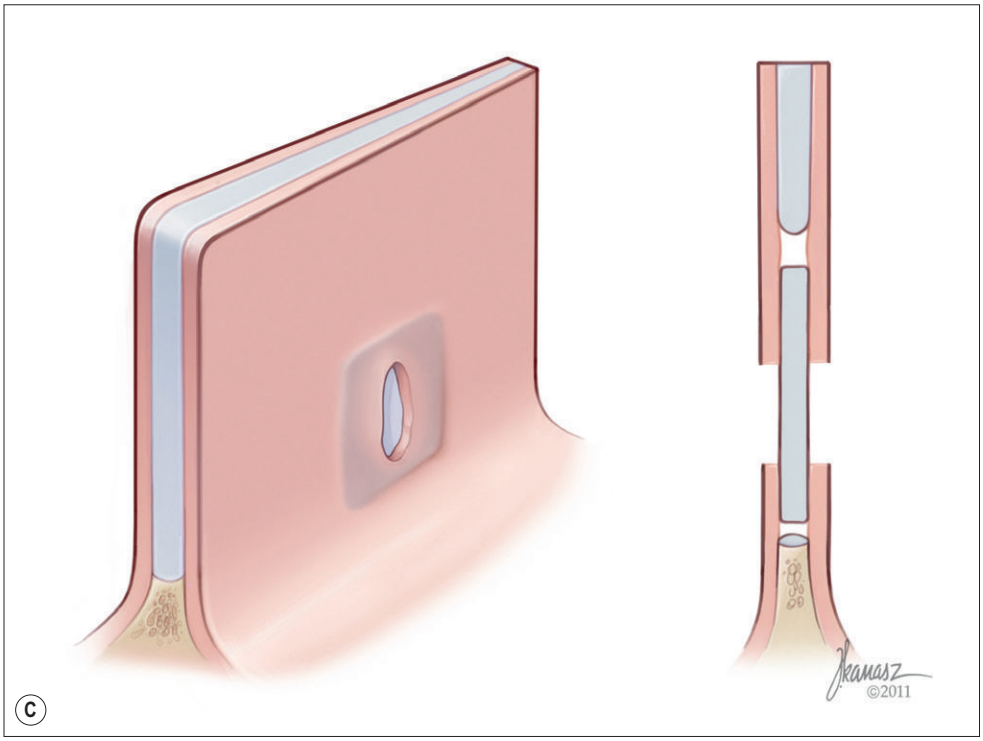


Figure 19.30 To repair a chronic perforation of the septum, a pocket is created and a straight piece of septal or conchal cartilage is advanced in position. Simple stents are applied to either side to maintain the cartilage in position and aid re-epithelialization.



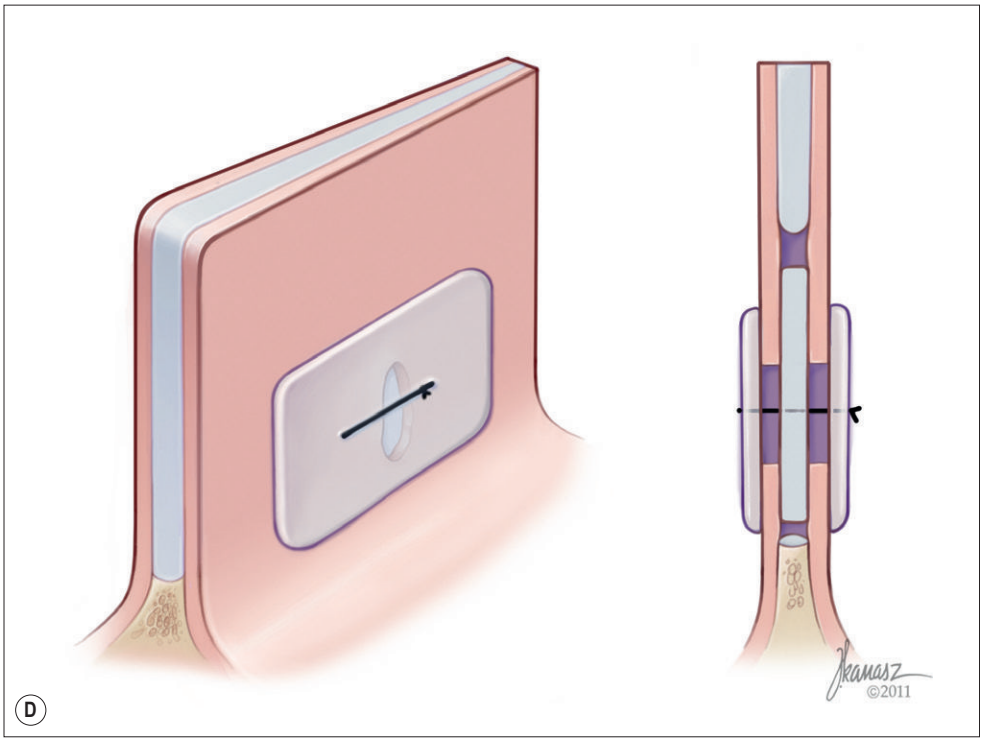


Figure 19.30, cont'd.

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20 CHAPTER

Prevention and Management of Rhinoplasty Complications

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Pearls

- The intraoperative complications of rhinoplasty include excessive bleeding, loss of dorsal support due to fracture of the L frame, unstable nasal bones and septal perforation.
- The short-term postoperative complications of rhinoplasty include infection, epistaxis, airway occlusion, hematoma, and dehiscence.

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- The most common reason for intraoperative bleeding is hypertension which should be corrected by the anesthesiologist.
- Von Willebrand disease type I and type IIa, which are the most common subtypes and represent the majority of patients with this condition, respond favorably to the infusion of DDAVP (desmopressin).
- Patients who are vegetarian or those who have been taking antibiotics for a long time could be deficient in vitamin K and may need replacement. This can be accomplished with 10 mg of vitamin K orally or intramuscularly starting the day before surgery.
- If the patient initially forms clots appropriately during the surgery but the clots are unstable, a process of fibrinolysis should be suspected and can be treated with diffusion of aminocaproic acid.
- At one time the most common reason for intraoperative bleeding used to be the preoperative consumption of aspirin and aspirin-type nonsteroidal anti-inflammatory drugs (NSAIDs). With vigorous patient education, this condition has been reduced.
- Patients who are suspected to have consumed NSAIDS can also be treated successfully with DDAVP in most incidences.
- While most rhinoplasty authorities recommend leaving a 10 mm wide dorsal portion of the L strut, the author strongly recommends leaving at least a 15 mm dorsal strut to minimize the potential for postoperative loss of support.
- Unstable nasal bones that shift medially and posteriorly can be suspended from the septum by using the upper lateral cartilages or by passing sutures through the bone, and in rare incidences, by using K wires.
- Patients who have von Willebrand disease and receive intraoperative DDAVP with a presumptive diagnosis of this condition frequently have an episode of epistaxis 7–8 days after the surgery, which can be successfully treated with another infusion of DDAVP.
- Postoperative treatment of epistaxis includes control of hypertension, nose sprays with vasoconstrictive agents such as neosynephrine spray, and if it cannot be controlled, treatment with DDAVP.
- The incidence of revision rhinoplasty ranges from a minimum of 2% up to 25–30%, depending on the level of perfectionism of the surgeon and patient.
- In a recent study by the author's group, while minor flaws were noted by the author in 17% of patients, only 3% of patients underwent revision surgery, leaving 14% who chose not to have revision surgery.
- The most common presentation of nose infection following surgery is minor bleeding or bloody secretions, especially in the morning, which is an indication of infectious rhinitis; usually the culture will grow staphylococcal aureus.

- Use of PDS rather than permanent sutures, when feasible, can reduce the incidence of suture-related infection.
- Infections of the nasal cavity can often be successfully treated with topical application of Bactroban ointment.
- Commonly, very small perforations are symptomatic and cause whistling and larger perforations may result in crusting or bleeding, leading to the growth of bacteria.
- While the internal valve dysfunction will be associated with an inverted V deformity, the external valve collapse is commonly associated with a cloverleaf deformity.
- The majority of techniques utilized to redefine the nose, which are reductive in nature, will also result in reduction in the airway. These include nasal bone osteotomy with medialization of upper lateral cartilages, transdomal sutures, interdomal sutures, lateral crura spanning sutures, and convexity control sutures.
- Spreader grafts, turbinectomy, septoplasty, insertion of alar rim graft, tip rotation cephalically, and lateral crura strut can all result in improvement in the airway.

Complications of rhinoplasty, other than the flaws requiring revision surgery, are rare and very few articles have covered this topic.[1–3] The complications can occur intraoperatively, in the short term or in the long term postoperatively. Intraoperative complications are listed in Box 20.1. Short-term postoperative complications are those that occur within 1 week of surgery (Box 20.2) and long-term postoperative complications are experienced beyond the first week (Box 20.3).

BOX 20.1

Intraoperative Complications

- Excessive bleeding
- Loss of dorsal support
- Unstable nasal bones
- Septal perforation

BOX 20.2

Short-Term Postoperative Complications

- Infection
- Epistaxis
- Airway occlusion
- Hematoma
- Dehiscence

BOX 20.3

Long-Term Postoperative Complications

- Flaws, revisions
- Chronic infection
- Epistaxis
- Perforation
- Valve dysfunction
- Airway reduction
- Implant extrusion
- Epiphora
- Telangiectasis
- Synechiae
- Stenosis
- Graft loss
- Anosmia
- Rhinorrhea

Whether revision surgery can be considered to be a complication is open to debate. However, since the second surgery is not an expected part of the initial rhinoplasty, in my opinion it should be regarded as a complication. Each category of complication will be discussed separately.

Intraoperative Complications

Excessive Intraoperative Bleeding

One of the most disturbing and complicating events during any surgical procedure is excessive bleeding. This can obscure anatomical details and create frustration for the surgeon and the operating team. Additionally, excessive bleeding can cause significantly more edema, ecchymosis, and scarring and subsequently influence the final outcome. Therefore, it is crucial to control intraoperative bleeding to minimize the adverse consequences. However, despite careful preoperative preparation and intraoperative implementation of appropriate measures to reduce bleeding, excessive bleeding may occur and every surgeon must be capable of coping with this condition and prepared to deal with it.

The most common reason for intraoperative bleeding is hypertension. It is therefore prudent to seek information on this from the anesthesiologist immediately when excessive bleeding is encountered. Hypertension is most commonly induced by the sudden systemic absorption of the vasoactive agents contained in the local anesthetic or the nasal packing, both of which

are intended to cause vasoconstriction in the nose, septum, and turbinates. The level of anesthesia also plays a significant role in controlling hypertension. Inadequate depth of anesthesia at the beginning of the surgery, during the operation, or at the time of emergence from anesthesia, along with any painful stimulus, can result in a sudden rise of blood pressure and thus excessive bleeding. This type of abnormal bleeding should not occur often and can be readily controlled if the anesthesia is provided by an experienced attendant and certain measures are implemented by the surgical team. Injection of the turbinates, placement of gauze saturated with vasoactive agent in the nose, and subsequent injection of the nasal soft tissues must be done gently and in a systematic manner. Throughout the process, there should be constant communication between the anesthesiologist and the surgeon. The injections should be titrated to prevent a sudden rise in blood pressure. Additionally, the double injection technique described in Chapter 4 minimizes the systemic effect of injected vasoactive agents. Furthermore, the injection must be targeted to cause thorough vasoconstriction in all the surrounding superficial and deeper vessels on the exterior and interior surfaces of the nose. The rate of infusion and the content of the intravenous fluid should also be watched closely. If a patient, especially an older patient, receives too much salt-containing solution, the result will be an uncontrollable rise in blood pressure, which may persist postoperatively. Such excessive fluid administration may also result in dilution of coagulation factors, disturbance of the clotting cascade, and exaggerated postoperative swelling.

Uncontrolled preoperative hypertension can be a major adverse factor intra- and postoperatively. Such patients are extremely sensitive to vasoactive materials and blood pressure will rise significantly immediately upon injection of epinephrine-containing solutions or any type of painful stimulation. It is, therefore, crucial to control hypertension preoperatively in all patients. Those patients who are hypertensive during the surgery may require antihypertension medication intraoperatively, which should be continued during the immediate postoperative period. Younger patients who undergo surgery in the late afternoon have a greater propensity to develop hypertension from the injected vasoactive materials because of an abundance of circulating catecholamines. It is, therefore, essential that intraoperative hypertension is rigorously controlled by the anesthesiologist throughout the surgery.

If excessive bleeding is observed in the absence of hypertension, the most likely possibility is some type of insidious coagulopathy. The majority of patients who bleed without a prior history are likely either to have von Willebrand disease[4,5] or to have consumed some pharmaceutical or herbal product with a detrimental effect on coagulation. Some patients may form clots, but due to fibrinolysis the clots may not be stable. Additionally, patients who adhere to a vegetarian diet may experience more bleeding than usual due to inadequate absorption of vitamin K. Moreover, patients who have been on antibiotics for a long time may have experienced a change in intestinal

flora that alters the absorption of vitamin K. This group of patients should be identified and should receive vitamin K preoperatively and, if necessary, intraoperatively. A prescription of 10 mg of oral or intramuscular vitamin K, commencing the day before surgery, may benefit patients who bleed excessively, especially those who are known to be vegetarians.

Von Willebrand disease type I and type IIa, which are the most common subtypes and represent the majority of patients with this condition, respond favorably to the infusion of DDAVP (desmopressin). The usual dose of DDAVP is 0.3 μg/kg of body weight. This is dissolved in 50–75 ml of saline and infused over a period of 30–45 minutes. DDAVP almost invariably reverses the condition and stabilizes the hemostasis. Although testing for von Willebrand disease during surgery may yield some meaningful information, results are not always reliable because of natural fluctuations in levels of von Willebrand factor, and response to surgery may specifically alter these levels. Moreover, the test results will not be available in time to help with intraoperative treatment decisions. A more reliable time to run this test is at least 1 week after surgery. Nevertheless, if intraoperative serum levels are abnormally low, it would be clearly diagnostic.

Infusion of DDAVP, with or without vitamin K, often effectively stops the bleeding and allows the surgery to be completed. Side effects of administration of DDAVP include slight hypotension, reduction in urine output, and retention of fluid for approximately 24 hours. If the patient starts bleeding after the initial cessation following infusion of DDAVP, the dose of DDAVP can be repeated every 8 hours for an additional two doses. The patient may need one more dose about a week following surgery, but only if another episode of epistaxis is encountered, which is not uncommon in patients with von Willebrand disease.

If the patient initially forms clots appropriately but the clots are unstable, which will result in bleeding off and on, an antifibrinolytic agent such as aminocaproic acid is effective. The usual dose is 4–5 g, which is dissolved in 250 ml of physiological saline and infused slowly. If bleeding is encountered postoperatively while the patient is awake, 1 g of aminocaproic acid is administered orally every hour for 8 hours. If a hematology consultation is feasible and the blood sample can be tested for fibrinolysis, this should be done before starting the treatment.

As a last resort, fresh frozen plasma can be infused. However, this may require transferring the patient to a facility where blood products can be infused. This has never become necessary in my 31 years of experience.

At one time the most common reason for intraoperative bleeding was the preoperative consumption of aspirin and aspirin-type nonsteroidal anti-inflammatory drugs (NSAIDs). With rigorous patient education, the incidence of bleeding related to the consumption of these pharmaceutical agents has

greatly diminished, but has not been eliminated completely. Excessive bleeding related to the use of aspirin or NSAIDs commonly also responds favorably to infusion of DDAVP.

Factor 11 and 13 deficiency, which is rare, can also cause excessive intraoperative bleeding. With either of these conditions, if the bleeding does not stop, use of fresh frozen plasma would be indicated.

Loss of Dorsal Support

This complication can occur for one of two reasons. The less common cause of dorsal collapse is loss of dorsal support due to cocaine abuse or infection. More commonly, this complication occurs as a consequence of zealous and imprudent septoplasty, leaving insufficient support for the dorsum. Although most experts recommend leaving at least 10 mm of dorsal L-shaped frame, in my experience this is not adequate and can result in sinking of the dorsal frame postoperatively. This causes an unstable dorsal frame and formation of a hump that was not present intraoperatively, which may not become apparent until several months after surgery. More importantly, and pertinent to this discussion, since the dorsal bar is not strong enough it can fracture easily and the nose may rotate cephalically and posteriorly while the osteotomy is being completed. It is therefore essential to leave at least 15 mm of cartilage for the dorsal support, although caudally cartilage 10 mm wide might be sufficient. It is also for this reason that frequent examination of dorsal stability after septoplasty and nasal osteotomy is crucial to ensure that the patient and surgeon will not be surprised postoperatively by unanticipated changes. Should dorsal instability be encountered, the nasal bones must be checked first. If they are stable, since the upper lateral cartilages often have adequate attachment to the nasal bones, they can be effectively used to stabilize the septum. After spreader grafts are placed in position and sutured to the septum, the septum is lifted to a proper position and sutured to the upper lateral cartilages. This very commonly stabilizes the unstable septum. In the extremely rare situation where the nasal bones are unstable, it may be necessary to pass two K wires through them while the anterior border of the septum is aligned with the rest of the dorsum in an optimal position. The K wires are passed through both nasal bones and the septum and brought out through the skin on the opposite side. They are kept in place for 3 weeks. The patient is maintained on antibiotics throughout this period. Alternatively, one can use a 5-0 nylon stitch through the burr holes in the nasal bones to suspend the septal cartilage without K wires, depending on the condition and stability of the nasal frame.

Unstable Nasal Bones

This condition can occur, especially in older patients who have brittle nasal bones and who are unlikely to have a greenstick fracture. The bones may sink

into the nasal cavity or shift too far medially. Commonly, they can be repositioned and an interposition absorbable packing such as Surgicel™ is inserted between the septum and nasal bone to avoid medial transposition, after insertion of spreader grafts and approximation of the upper lateral cartilages to the spreader grafts. Essentially, the septum and the spreader grafts are used to stabilize the unstable nasal bones. However, if the instability is significant, one can use either trans-septal sutures to suspend the nasal bones or K wires to stabilize them.

Septal Perforation

Perforation of the septum during septoplasty is exceedingly common, especially when a sharp spur or an extreme deflection of the septum is present. Dissection of the mucoperichondrium around a sharp angle of the spur sometimes becomes very difficult and, on occasions, impossible. It is essential to start elevation of the mucoperichondrium on the concave side of the septum so the lining on at least one side of the septum is kept intact. If a unilateral septal perforation occurs, as long as the opposite mucoperichondrium is intact, no other measures will be necessary. Usually, the septum heals uneventfully without any attempt at repair of the unilateral perforation. If the perforations occur bilaterally but are not apposing, they are not repaired and the surgeon may consider placing back a straight septal cartilage or a piece of PDS foil. However, this is not absolutely necessary, and the surgeon only repairs the incision, ignoring the non-apposing perforations in the septum. Chronic perforations almost invariably ensue if apposing tears in the mucosa are not dealt with properly. In this scenario, a straight piece of the septal cartilage, a perpendicular plate of the ethmoid bone, or a piece of PDS foil is placed between the two mucoperichondrial layers to prevent free flow of air through the perforations. This is followed by repair of the original incision in the septum, if one has been made, without any attempt to repair the perforations. Next, a simple stent (SupraMed) is tailored to a size long and wide enough to span across the perforation, applied on either side of the septum, and then fixed in position using 4-0 polypropylene through-and-through sutures. Alternatively, Doyle stents can be placed and kept in position for at least 2 and preferably 3 weeks, depending on the size of the perforation, similar to repair of perforation as discussed in Chapter 19. A chronic perforation may be avoided in the majority of patients by adhering to these principles.

Short-Term Postoperative Complications

Infection

Since septorhinoplasty is performed within the respiratory tract, achieving a completely sterile field is very difficult, if not impossible. Consequently, infection can occur following rhinoplasty. However, because of the robust

Table 20.1 Incidence of Complications in the Early Postoperative Period

Complication	Incidence (%)	Treatment
Cellulitis	3	Oral antibiotics
Sinusitis	2	Oral antibiotics
Epistaxis	1	DDAVP

circulation in this site, the incidence of infection is extremely low (Table 20.1). The author routinely uses antibiotics during the period when the Doyle stents are in place to minimize the risk of toxic shock syndrome.

Epistaxis

Postoperative epistaxis can occur any time after surgery. Immediate postoperative epistaxis is commonly related to hypertension resulting from uncontrolled or poorly controlled pain, nausea, and vomiting. Nausea and vomiting should be treated vigorously with antiemetic medications such as a promethazine suppository or ondansetron. If the patient is vomiting, use of oral antiemetics is not prudent. Postoperative nausea is commonly related to the consumption of narcotic pain medications without adequate food intake. It is crucial to instruct patients to eat an adequate amount of food shortly after taking narcotic medications to prevent or minimize nausea and vomiting.

If blood pressure is under control and the patient is bleeding excessively through the nose, use of DDAVP as discussed earlier may also become necessary in this phase. In 31 years of rhinoplasty experience, the author has never needed to pack the nose to control bleeding. Invariably, measures to control pain, nausea and vomiting, and infusion of DDAVP with or without vitamin K, have been effective in controlling epistaxis. Not uncommonly, this occurs about 7–10 days after surgery. Treatment is initially conservative. If the bleeding does not stop within 10–15 minutes of the application of gentle pressure with gauze and head elevation, use of Neo-Synephrine™ spray, as well as control of pressure, followed by infusion of DDAVP, will be indicated.

Hematoma

Hematoma following rhinoplasty is exceedingly rare because intraoperative bleeding has usually stopped prior to the repair of the incision and dead space is eliminated by the use of Doyle stents and external splints. Hematomas are almost invariably the consequence of a period of hypotension during surgery followed by a period of hypertension postoperatively related to inadequate control of pain, nausea and vomiting, or excessive infusion of intravenous fluids, which temporarily adds to the circulating blood volume and dilutes

coagulation factors. Whenever a hematoma is discovered, it should be drained, and the wound should be irrigated and repaired.

Dehiscence

There are three sites where dehiscence can occur: the columella incision and both alar bases. Dehiscence is a more likely possibility when a short nose is elongated and there is a good deal of tension on the repaired incision in the columella. It is therefore advisable to use a deeper suture, for example of 6-0 poliglecaprone, to approximate the deeper soft tissues of the columella prior to repair of a skin flap that appears to be tight. Alar base dehiscence is very rare but, in patients who are suspected to have delayed healing, layered repair of the alar base excision may provide additional safety.

Asymmetry

Detection of asymmetric nostrils, alar position, and tip is difficult during the first postoperative week due to the presence of the bandages. If asymmetry is noted, it should not prompt the surgeon to hastily explore the site. Uneven swelling or even the presence of a blood clot within the nostril can induce asymmetry. Judgment about this type of asymmetry should be deferred until healing is complete. Asymmetry in the direction of the nose can also be difficult to judge at this stage. This should not cause alarm and prompt the surgeon to revise the nose surgery. On rare occasions, the deviation may respond to gentle manual repositioning and differential taping of the nose.

Long-Term Postoperative Complications

Flaws and Revisions

Flaws requiring revisions are the most common complications of rhinoplasty. The incidence ranges from very minimal up to 25–30%. In reality, very few noses are absolutely perfect. On careful scrutiny, one can always find some minor imperfections in noses that are considered flawless. As indicated in Chapter 19, the need for revision surgery is directly proportional to the level of perfectionism of the surgeon and patient. The ultimate goal of rhinoplasty should be a perfect nose. In a recent study by the author's group, flaws were noted by the author in 17% of patients, who were recommended to have revision surgery.[6] However, 14% of these chose not to undergo surgery as these flaws were either not visible to them or were small enough for them not to feel the need for revision surgery. Usually, depending on the level of experience of the surgeon, such revisions are extremely insignificant and can commonly be carried out with minimal surgery and a very short recovery period. Revision surgery is more extensively discussed in Chapter 19.

Infection

Long-term post-rhinoplasty infection is exceedingly rare and its presentation varies from patient to patient. This type of infection may be related to permanent sutures that were used or alloplastic materials implanted in the nose. The patient may experience some localized swelling, discomfort, and redness, which may come and go until the permanent suture or implant is removed. For this reason the author's use of permanent sutures has become limited to suspension and rotation of the tip only, since the intention is to keep the tip permanently in a certain position and prevent any gravity- and aging-related caudal rotation. The sutures used for remodeling of the cartilages are PDS and it has been demonstrated that permanent sutures are not necessary to alter the cartilage shape.

Long-term infections in the septum and turbinates can also manifest as bloody staining of the nasal drainage, especially in the morning. This type of presentation is usually the consequence of a staphylococcal infection causing minimal erosion of the nasal lining and can be treated effectively with systemic antibiotics or topical medications such as mupirocin ointment. Rarely, this type of infection can result in more significant bleeding. Sometimes the infection is related to a K wire or other permanent prosthetic material. If the K wire for stabilization of dorsal augmentation grafts is placed vertically through the cartilage so that the end of the wire penetrates the nasal mucosa, it may seed bacteria into the cartilage at the time of retrieval of the wire. It is, therefore, crucial to avoid penetration of the nasal lining when a K wire is placed.

Epistaxis

A major episode of epistaxis long after the rhinoplasty is exceedingly rare and is commonly related to septal perforation, chronic rhinitis, or intranasal infection. These conditions can be treated conservatively with a combination of culture-based systemic antibiotics and use of topical ointments such as mupirocin. However, if the bleeding is significant, it can be treated with DDAVP, as discussed above.

Perforation

If minor intraoperative nasal perforations are not treated properly, they can result in chronic, persistent perforations, which may become symptomatic if they are very small and cause whistling. Larger perforations may cause crusting, localized infection, and minimal bleeding, especially in the morning. The author believes that extensive perforations should not be repaired because the surgery required is very time-consuming and involves the use of free flaps within the nose. Because of their thickness, these flaps may occupy too much space inside the nose and cause greater airway occlusion with minimal or no

benefit. In reality, this type of repair may constrict the airway and thus trade one problem for another. Smaller perforations should be repaired if they are symptomatic. Repair of this type of perforation is effective and predictable. For perforations smaller than 1 cm, an interposition graft can be used as described in Chapter 19. A pocket is created through a hemitransfixion incision. The pocket is dissected beyond the perforation and a piece of cartilage or a perpendicular piece of bone is harvested and placed across the perforation to bridge the gap, similar to the procedure described in the section on Septal Perforation above. Simple splints are applied on either side and fixed in position using a through-and-through suture (see Figure 19.30 in Chapter 19). These are removed in 3 weeks, at which time the perforation is often completely healed and one commonly cannot identify the original site of perforation.

Valve Dysfunction

An internal valve dysfunction not only causes a functional deficit but also results in a very displeasing inverted V deformity. A cloverleaf deformity will be noticed if there is an external valve dysfunction along with the concavity of the alae. The former can be avoided or treated by placement of spreader grafts intraoperatively to support the internal valve and dorsal lines, and the latter can be prevented or treated by placement of an alar rim graft to support the external valve and create a more elegant transition from the alar rim to the tip.

Airway Reduction

The majority of the techniques used to redefine the nose, especially through a reduction rhinoplasty, have the potential to reduce the airway. Nasal osteotomy and repositioning of the upper lateral cartilage, as mentioned earlier, along with potential repositioning of the anterior portion of the inferior turbinate, can result in narrowing of the airway. Furthermore, when the lower lateral cartilages are repositioned medially by different maneuvers, this reduces the airflow through the external valve. Reduction of the dorsal hump by elimination of the horizontal bar between the dorsal septum and upper lateral cartilage reduces the airway by narrowing the internal valve. It is therefore important to make every effort to maintain the patency of the airway by placing a spreader graft and alar rim grafts, and eliminate other flaws such as a deviated septum and enlarged turbinates to compensate for the air flow decrease that will result from a reduction rhinoplasty.

Implant Extrusion

The majority of nasal implants placed in the superficial layers are doomed to extrusion. It is crucial that the surgeon is prepared to remove and replace

them with autogenous materials. Dorsal implants with sufficient soft tissue coverage may not need to be removed.

Graft-Related Complications

The majority of grafts will ultimately become noticeable through the skin if they are not carved properly. It is therefore very important to bevel the graft margins to make sure that the graft is not conspicuous on either short- or long-term observation. Grafts should be hidden, whenever possible, under the appropriate structures, such as under the domes, between the medial crura, and medial to the upper lateral cartilages, to reduce the potential for visibility.

Epiphora

A temporary dysfunction of the lacrimal system due to swelling is slightly more common than permanent epiphora, and lasts only a few days or a week at the most. Persistent epiphora is a consequence of an inadvertent fracture of the frontal process of the maxilla involving the lachrymal sac. If the tearing lasts more than 2 weeks, the lacrimal system should be studied carefully. If a blockage is identified, it may require surgical intervention after documentation of the site of the blockage.

Rhinorrhea

Rhinorrhea is an extremely rare complication of rhinoplasty and is commonly related to misdirection within the septum of the nerves that are supposed to be stimulating the palatal glands. This condition commonly responds favorably to ipratropium (Atovent™) nose spray.

Wire Exposure

Whenever a K wire is used, it may become visible when tension repositions the graft or part of the graft is absorbed. Ultimately, this type of exposure will necessitate the removal of the K wire with or without the addition of a new graft. Extraction of the exposed wire should not coincide with the addition of a new graft if there is any evidence of infection.

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21 CHAPTER

Rhinogenic Migraine Headaches

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Pearls

- 60% of migraineurs have rhinogenic trigger sites.
- Migraine headache pain originating from the nose and septum is usually located behind the eyes, is sensitive to hormonal and atmospheric pressure changes, is more prevalent in the morning and can wake the patient up at night, is associated with rhinorrhea and is exploding in nature (starts from deeper structures and travels superficially).
- The most common pathology found intranasally is a reverse C-shaped septal deviation with a spur and contact between the turbinates and septum, and presence of a concha bullosa of the middle turbinate, which is often found to be significantly larger and thicker than usual.
- Perinasal CT images may reveal septal deviation with spur, contact between the septum and turbinates, concha bullosa, septa bullosa, and Haller's cell, with or without a varying degree of sinusitis.
- The surgical treatment will include septoplasty, turbinectomy, and decompression of concha bullosa, septa bullosa or Haller's cell.

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Over 30 million Americans, approximately 12% of the population, including 18% of females and 6% of males, suffer from migraine headaches. The cost of migraine headache treatment is an enormous economic burden on our society and a combination of the cost of medications and loss of time from work exceeds $13 billion.[1–11] A large proportion of patients who experience migraine headaches have an active nasal trigger site. In our experience, 60% of patients with migraine headaches endure rhinogenic migraines. The understanding of this condition and the utilization of maneuvers to deactivate the relevant trigger is extremely rewarding for rhinoplasty patient and surgeon alike. It is very important to elicit information about the presence of migraine headaches by asking pertinent questions of patients requesting rhinoplasty. Many such patients do not volunteer the fact that they experience migraine headaches since they do not recognize the association.

It is crucial to have a neurologist make the diagnosis of migraine headaches. The differential diagnosis by a neurologist is important, since all the conditions that cause meningeal inflammation and irritation mimic migraine headache and the consequences of a wrong diagnosis can be devastating. Additionally, some patients experience rebound headaches, which will not be addressed by the surgery.

While medical control of migraine headaches is often successful, there is no medical treatment that eliminates symptoms after cessation of the effects of the pharmaceutical products. On the other hand, it has been demonstrated by the author's group and others that surgery can produce lasting results without the need for medication in patients who experience a complete elimination of the headaches, and better management and less need for medication in those who observe improvement.[12–20]

Symptoms of Rhinogenic Migraine Headaches

In patients who have rhinogenic trigger sites (Box 21.1), the pain starts from behind the eyes, it is commonly triggered by weather changes, the patient often wakes up with the pain in the morning or in the middle of night, and the

BOX 21.1

Symptoms of Rhinogenic Migraine Headaches

- Pain starts from behind the eye
- Triggered by weather changes
- Pain commonly awakens the sufferer in the morning or middle of the night
- Rhinorrhea on the affected side
- Pain described as exploding

nose frequently runs on the affected side. Menstrual-period-related migraine headaches are also usually triggered from the nose, since the turbinates are highly sensitive to hormone fluctuations. The pain is usually described as exploding (starts from the deeper structures and extends to the surface).[21]

Internal Nose Examination

Examination of inner nasal structures may reveal varying degrees of septal deviation. The most common presentation is a reverse C-shape deviation, with the curve facing the patient's right. There is often contact between the turbinates and the septum, with a large septal spur. Nasoendoscopy can further confirm these findings, and also reveal enlargement of the turbinates. Such patients sometimes respond favorably to the use of decongestants.

Radiological Findings

The best imaging for identification of intranasal pathology findings that contribute to rhinogenic migraine headaches is a computed tomography (CT) scan including sagittal and coronal views of the septum, turbinates, and paranasal sinuses. Commonly, these images demonstrate significant septal deviation and often a sharp spur protruding into the inferior and middle turbinate or even reaching the lateral nasal wall (Figures 21.1, 21.2). The middle, superior or inferior turbinates could be in contact with the septum. Additionally, the images may demonstrate the presence of concha bullosa, paradoxical curl of the middle turbinate (Figure 21.3), septa bullosa (Figure 21.4), or Haller's cell.

Surgical Candidates

The ideal surgical candidates are those who have been examined by a neurologist and have at least two migraine headaches per month that are severe enough to require prescription medications and significantly alter the patient's quality of life. However, if the patient is undergoing septorhinoplasty for other reasons, incorporation of maneuvers to eliminate the contact points or migraine-related pathology improve the airway and will make the surgery results more gratifying. Under this condition, adherence to the criterion for minimum frequency of migraine headaches is not crucial.

Surgical Treatment

Routine septoplasty and potential inferior turbinectomy, described in Chapter 17, help the majority of patients with rhinogenic migraine headaches. However,

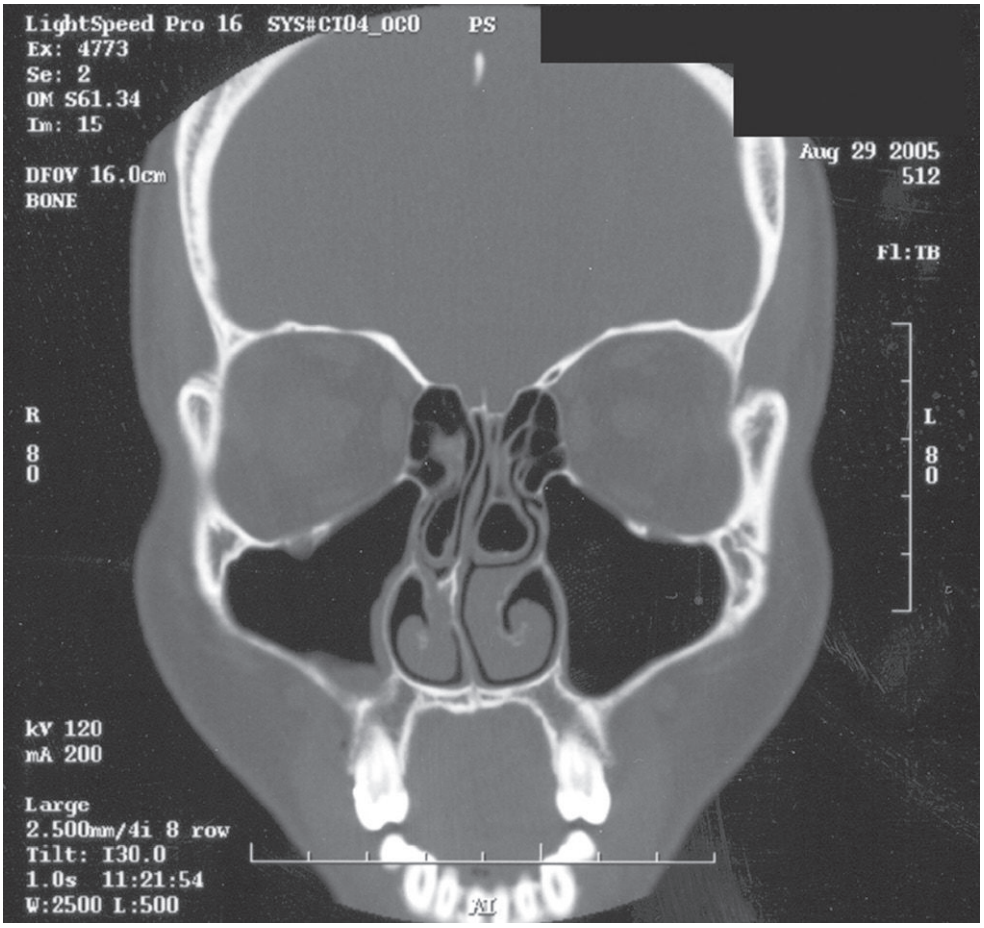

Figure 21.1 CT scan demonstrating contact between the septum and the left middle and right inferior turbinate, concha bullosa of the middle turbinates, and thickening of the maxillary sinus lining.

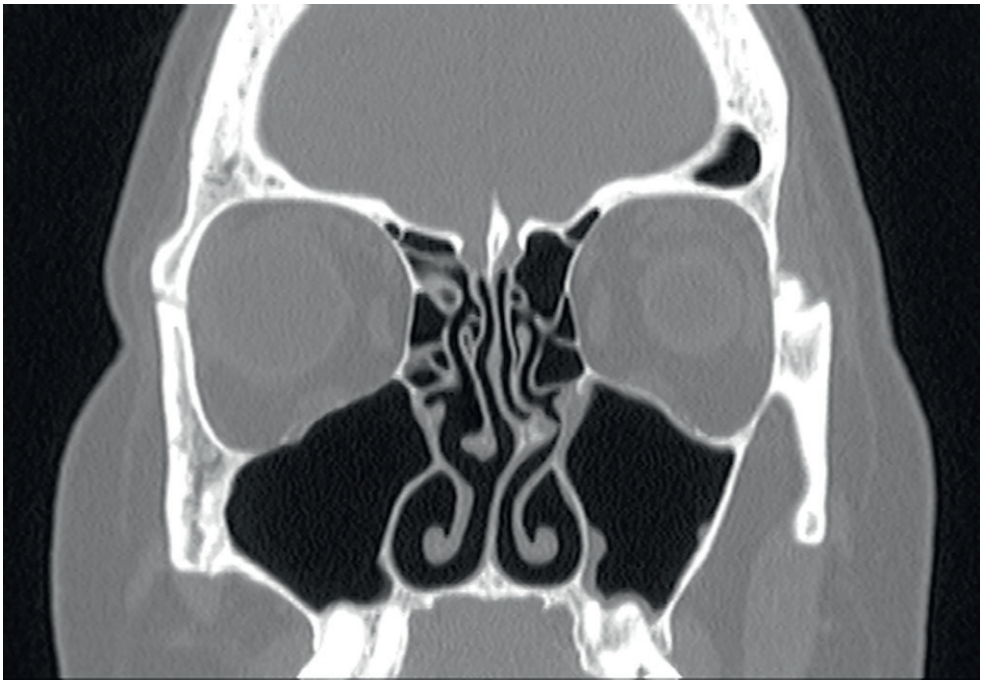

Figure 21.2 CT scan demonstrating a large spur that reaches the side wall of the nose and is in contact with the middle turbinates, along with left maxillary sinus pathology.

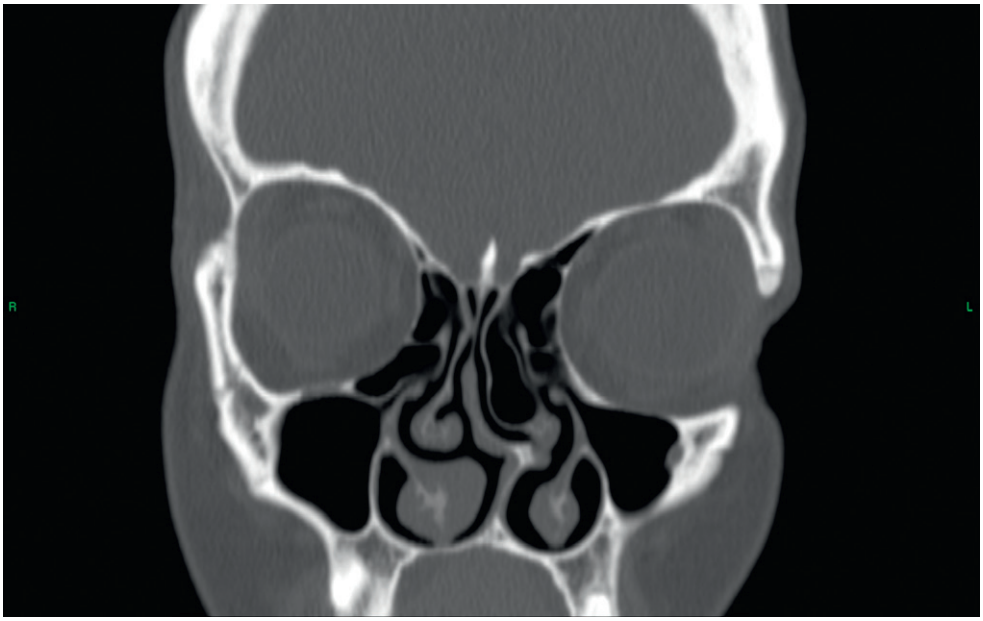

Figure 21.3 CT scan demonstrating paradoxical curl of the right middle turbinate, contact between the left middle turbinate and a septal spur, and left middle turbinate concha bullosa.

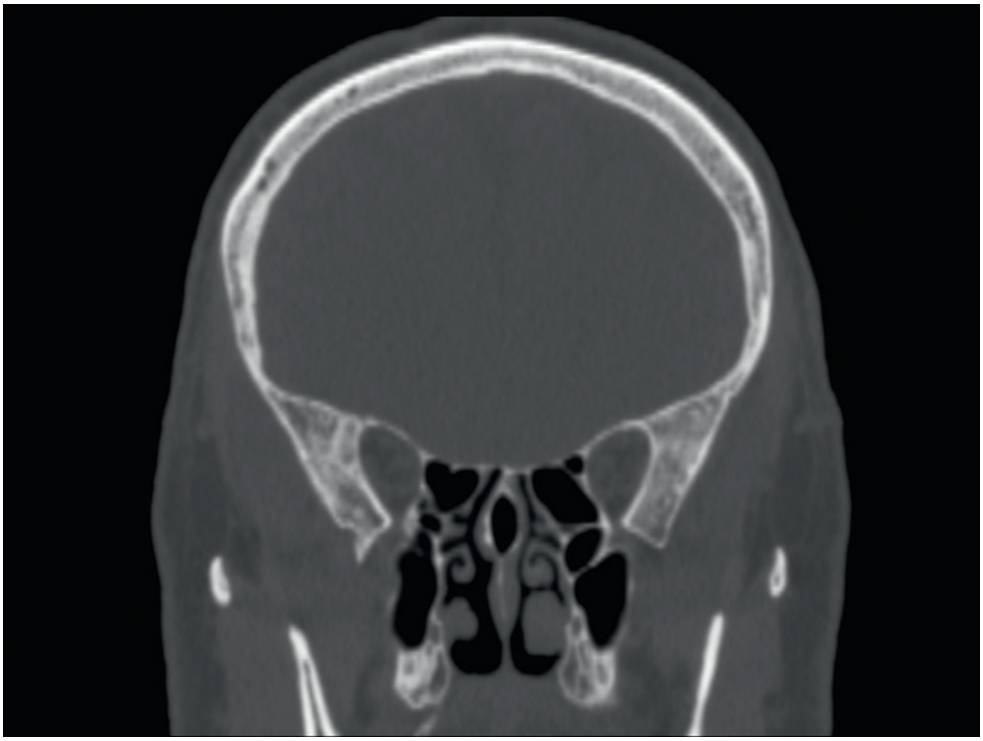

Figure 21.4 CT scan demonstrating septa bullosa.

Figure 21.5 The medial wall of a concha bullosa after its removal.

those who have concha bullosa of the middle or superior turbinates may require removal of the medial wall of the middle or superior turbinate (Figure 21.5). If removal of the medial wall destabilizes the turbinate, it may necessitate removal of the rest of the middle or even the superior turbinate. A complete septoplasty commonly decompresses the septa bullosa. After the septoplasty, Doyle stents are placed and fixed in position with 5-0 polypropylene suture as described in Chapter 4. The stents are kept in place for 5 days postoperatively. Such patients require gentle irrigation of the nose with premixed solutions containing sodium chloride and sodium bicarbonate (Sinus Rinse™, NeilMed), which is started approximately 1 week after the surgery. Patients are asked to avoid blowing their noses for 3 weeks. In order to minimize sinus infections, patients are kept on antibiotics for at least 1 week postoperatively. If there is evidence of scabbing or significant delayed healing, the antibiotics may be continued for 2–3 weeks.

Postoperative Care

Patients will continue to use migraine medications if they are symptomatic during the healing process. The presence of symptoms during the early postoperative period should not be discouraging to the patient or the surgeon. Of the different migraine trigger sites, this is the one that may take the longest for the symptoms to disappear, sometimes up to 3–6 months. However, a good number of patients experience positive effects soon after surgery and find the surgery highly beneficial.

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